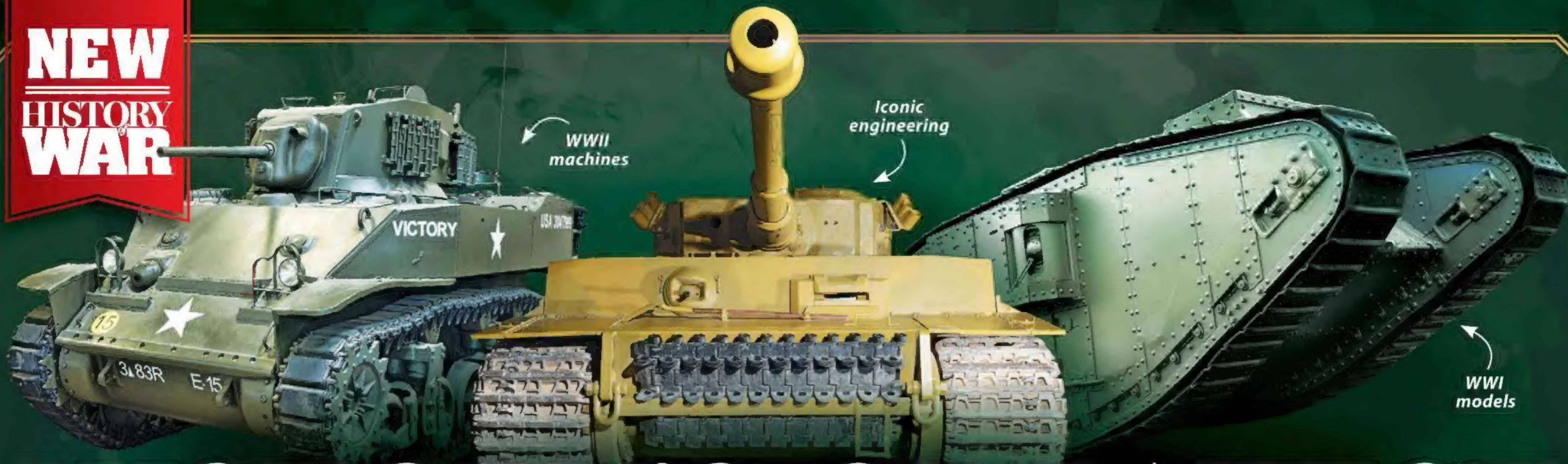


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WAR**



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★ SHERMAN ★ MATILDA ★ PANTHER ★ ABRAMS ★ CHALLENGER ★ T-34

**Digital
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FIRST
EDITION



“ON THE WAY!”

So went the cry of countless tank gunners as they fired their lethal load at the hulking silhouette of a machine much like theirs, be it on the mangled fields of the Western Front in WWI or the windswept plains of the Middle East. Tanks have prowled battlefields across the globe for over a century, and during that time they have changed the course of major conflicts and undergone remarkable technological evolutions. Prepare to jump inside some of the most iconic monsters ever to grind their way into combat and find out what the future holds for the tanks of tomorrow.

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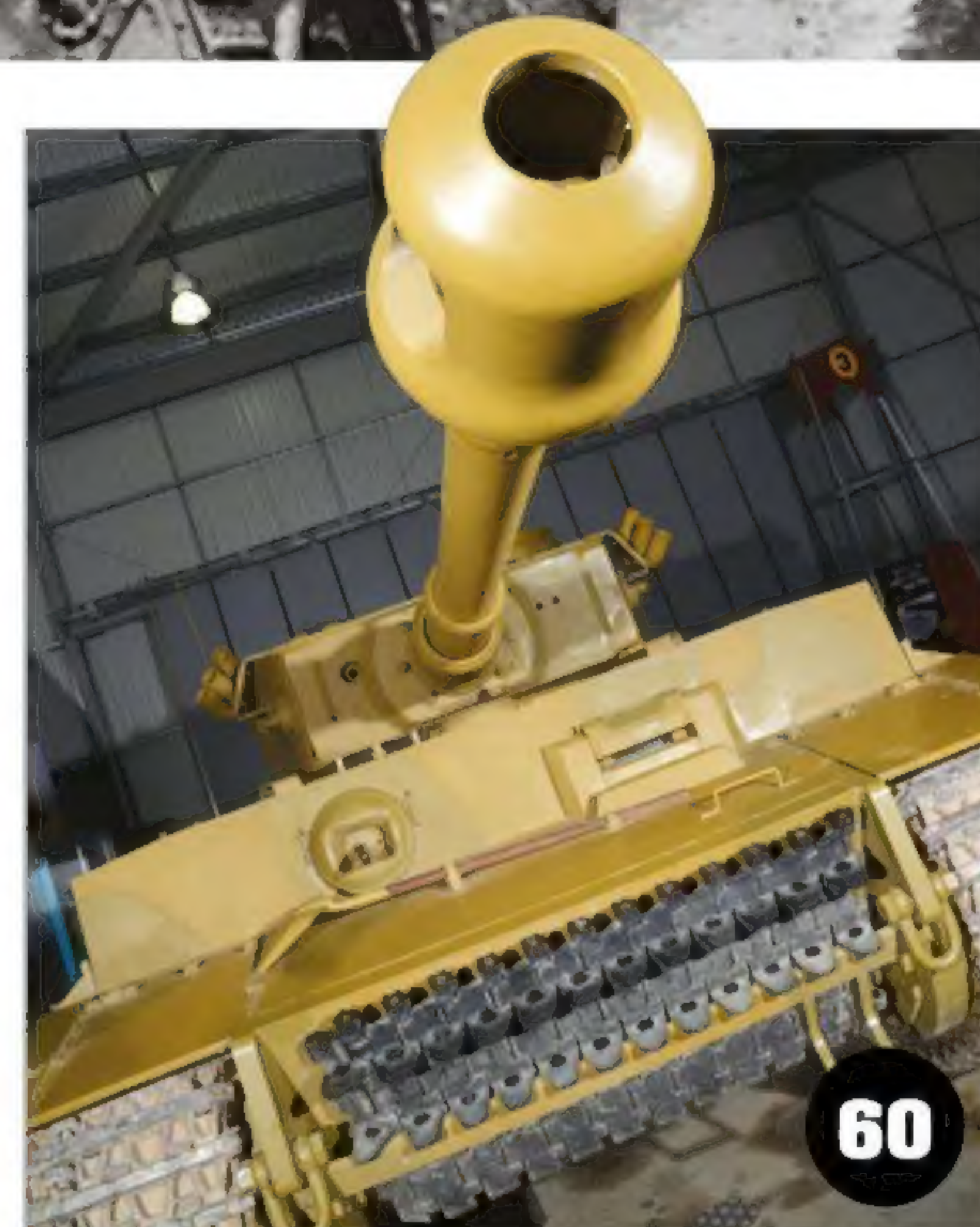
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**“IF THE TANKS SUCCEED,
THEN VICTORY FOLLOWS”**
– GENERAL HEINZ GUDERIAN

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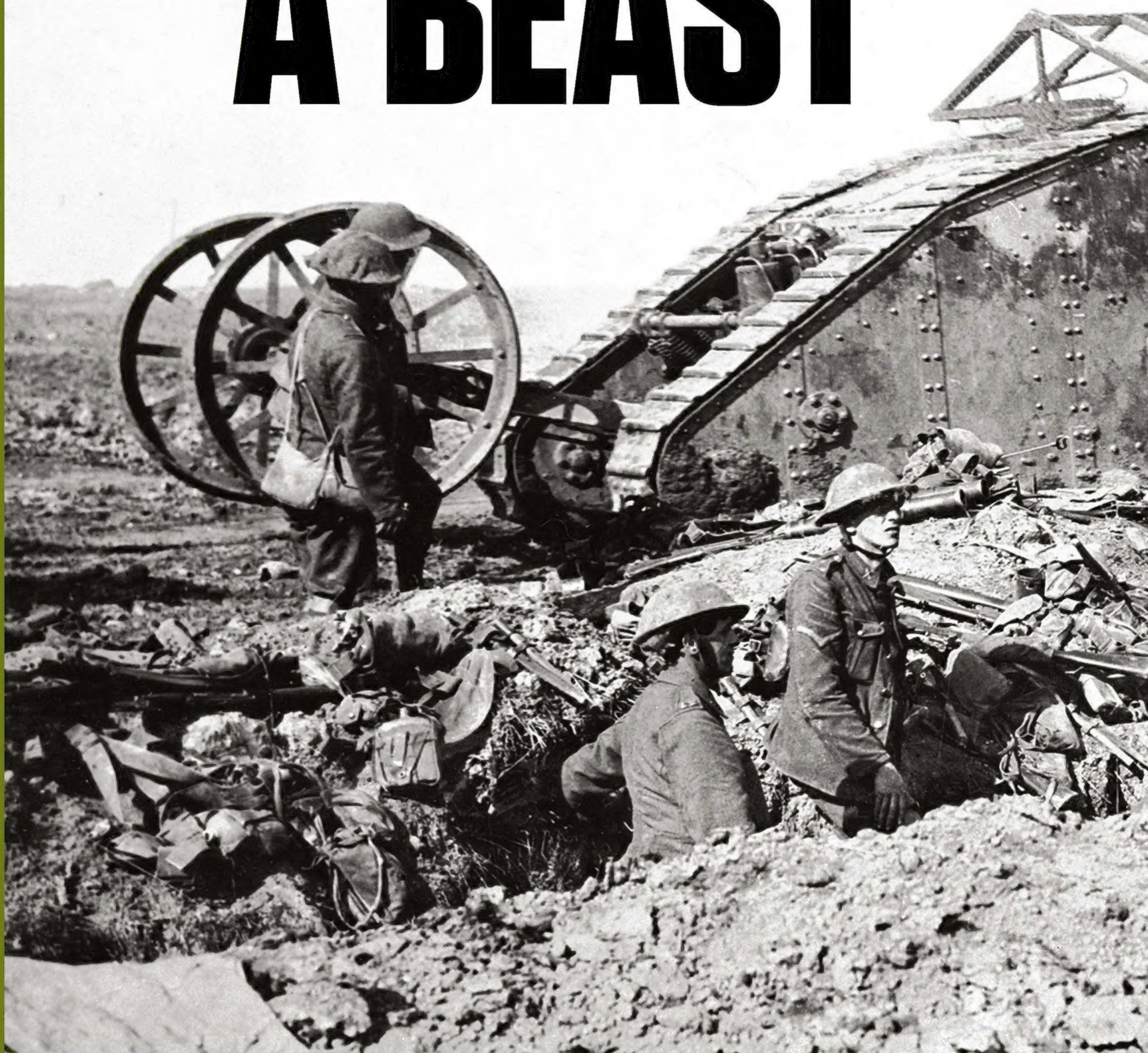
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This Soviet-era tank is playing a key role in the war in Ukraine and beyond

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BIRTH OF A BEAST



WAR IS THE MOTHER OF INVENTION, AND IT WOULD BE WWI THAT WOULD GIVE RISE TO A NEW, UNMISTAKABLE TERROR WITH THE POTENTIAL TO REVOLUTIONISE COMBAT: THE TANK

Inset: As often occurred during the heat of battle, this Mark I tank broke down while attempting to cross a trench, September 1916



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LITTLE WILLIE & THE PROTOTYPES

First conceived centuries before, the tank finally rolled off
the production line and onto the battlefield during WWI

WORDS MICHAEL E. HASKEW



This Belgian Minerva armoured car and crew were photographed in November 1914 during World War I



In the December 1903 edition of the *Strand Magazine*, science-fiction author H. G. Wells penned a dark vision of the battlefield of the future. Mammoth armoured fighting vehicles dominated the landscape, rolling inexorably forward against the enemy spewing a heavy volume of fire. Wells called these war vehicles “ironclads” and described them as “...essentially long, narrow, and very strong steel frameworks carrying the engines, and borne upon eight pairs of big pedrail wheels, each about ten feet in diameter, each a driving wheel and set upon long axles free to swivel round a common axis. This arrangement gave them the maximum of adaptability to the contours of the ground. They crawled level along the ground with one foot high upon a hillock and another deep in a depression, and they could hold themselves erect and steady sideways upon even a steep hillside.”

Interestingly, Wells seemed to foresee the advent of the tank and its potential on the battlefield. However, the concept of the armoured fighting vehicle exerting its sheer power in battle was not his alone. The ancient Greeks had their own tank of sorts. The phalanx was formed by hoplite warriors interlocking their shields to ward off spears, arrows and sword thrusts while attacking as a single unit – an ancient tank if you will. The chariots of the Bronze Age also reflected the notion of the tank, providing speed and firepower to the armies of Assyria, Egypt and even Alexander the Great.

Four hundred years before the tank appeared on the battlefield during WWI, Renaissance artist and inventor Leonardo da Vinci designed his own armoured fighting vehicle. Studded with gun ports, da Vinci’s tank design demonstrated that the theory of such a transformational weapon was possible and perhaps at some point practical. His conceptual tank of the 15th century was designed as a circular vehicle powered by men turning a pair of large cranks that propelled a system of wheels. The balance of weight, firepower and mobility had been identified.

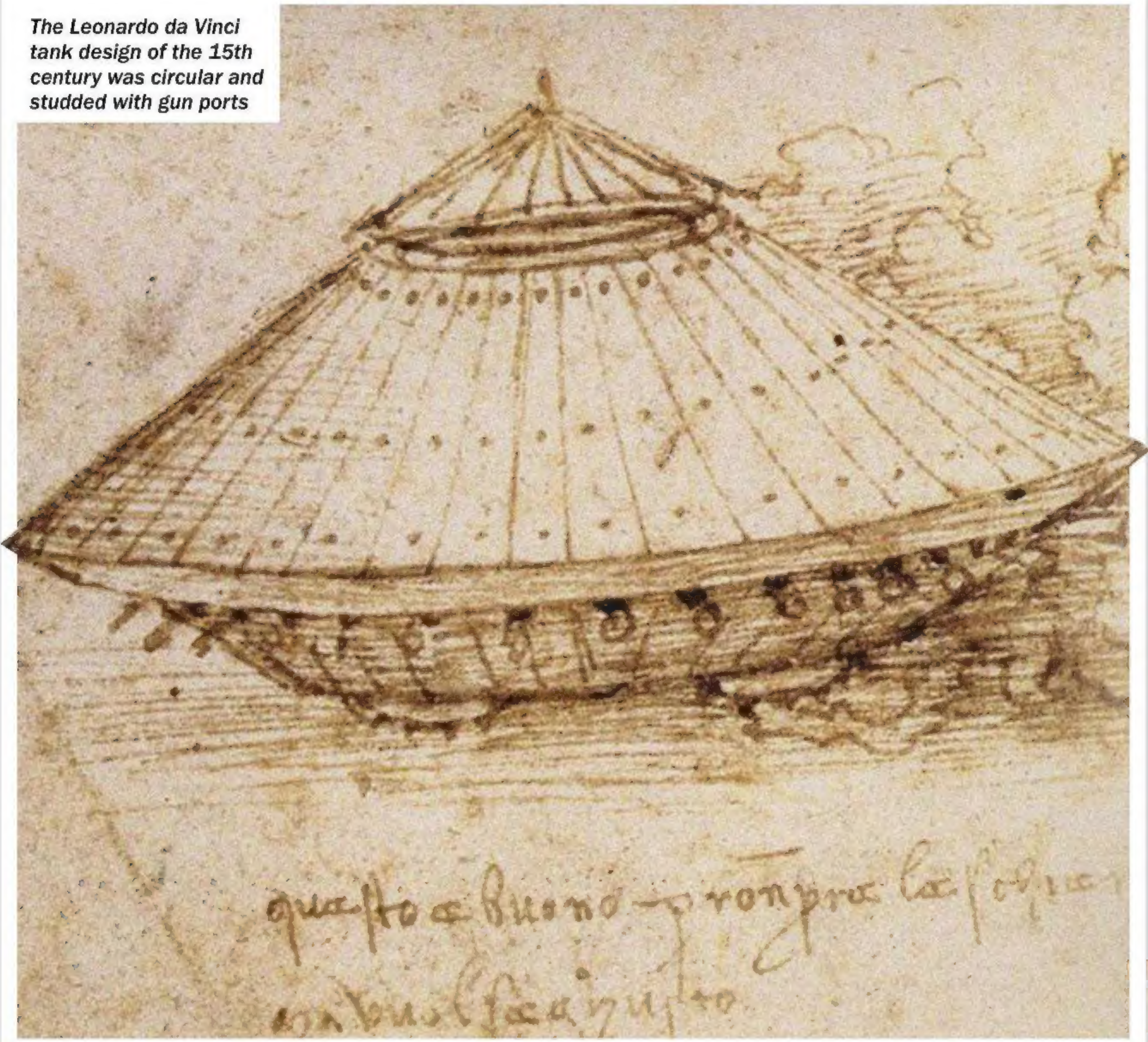
The concept of the modern tank was facilitated by the emergence of ancillary technology. Armour plating was developed first for the protection of warships, while advances in weaponry – such as the machine gun, large-calibre rifled cannon and the reliable shoulder arm – were accompanied by advances with the internal combustion engine, progressing from steam to petrol power, and the invention of the caterpillar track in the late 19th century/early 20th century. In combination, it was no great leap to theorise that the tank might become a war-winning weapon in its own right. One of the key components of early tank manufacture was the Holt tractor, which utilised the caterpillar track and was in widespread use as a mover for artillery and vehicle recovery during the Great War.

During the Boer Wars, British engineers experimented with steam power, but great leaps in the development of the petrol engine spurred speculation and research into the armoured fighting vehicle across Europe. The precursor to the first operational tank was the armoured car, or “war car”, and the Belgian Army led the way with the open-topped armed Minerva.

By 1916, Royal Navy Petty Officer L. Gutteridge had designed an armoured car based on the Ford Model T that entered service with other types. The French Charron, Girardot et Voigt, a 1902 design, may rightly be labelled as the first true military armoured car.

Across Europe inventive military officers and engineers proffered ideas for wheeled, tracked and armoured fighting vehicles. A French Army captain named Léon Levassieur pursued his “automobile cannon project”. Austrian Army lieutenant Gunther Burstyn designed his motor vehicle gun – the first of its kind to employ a turret – in 1911, but it was rejected, and German tank development lapsed completely until WWI. Imperial Russia was in the throes of political turmoil during the period, but engineer Aleksandr Porokhovschikova worked on his Vezdekhod all-terrain

The Leonardo da Vinci tank design of the 15th century was circular and studded with gun ports



Lieutenant Colonel Ernest Swinton was an early advocate for the development of British tanks



Little Willie is on display at The Tank Museum in Bovington, England

vehicle, protected by eight millimetres of armour in overlapping sheets, the world's first vehicle with such layered protection. Russian shipyard engineer Vasily Mendelev was concurrently designing a 170-ton behemoth intended to be transported to the battlefield on a rail car and then lowered to the ground.

Australian engineer Lancelot Eldin de Mole proposed a tank design to the British War Office in 1912, but he was turned away due to the War Office's perceived lack of military necessity. De Mole put forth two more tank designs after the outbreak of the Great War. In 1914 and 1916 his ideas were discounted not only because of indifference but also because much of his material was simply set aside or misplaced. Only after the war was his contribution to overall British tank design acknowledged by a special proclamation from an appointed royal commission.

With the outbreak of WWI, Britain stepped to the forefront of tank development. A quantity of Holt tractors had been purchased and field tested at Aldershot, supposedly on the recommendation of Lieutenant Colonel Ernest Swinton, appointed as a war correspondent by Secretary of State for War Lord Kitchener. While driving from St Omer to Calais on 1 October 1914, Swinton surveyed the French countryside and imagined the Holt tractor configured as a weapon of war. He reported the theory to Sir Maurice Hankey, secretary of the War Council.

In turn, Hankey used key contacts within the Royal Navy, which already had more experience in armoured cars than other branches of the military, and First Lord of the Admiralty Winston Churchill eagerly formed the Landship



A Mark I Male tank is shown on the battlefield in 1916. Note the six-pounder gun sponson and the trailing wheel

Committee, composed of naval officers, government officials and engineers. By the summer of 1915, Major Walter G. Wilson and Sir William A. Tritton, an authority on agricultural machinery, had spearheaded the development of a prototype.

Initially called the Number 1 Lincoln Machine, this small armoured vehicle became known as “Little Willie”. Weighing just over 18 tons, its armour was configured from boiler plate. It mounted a Vickers two-pounder gun and at least one secondary machine gun. Powered by a 105-horsepower Foster-Daimler Knight sleeve-valve gasoline engine, Little Willie’s top speed was 3.2 kilometres (two miles) per hour. A pair of trailing wheels assisted the tracked vehicle’s steering, and in trials Little Willie climbed a 30-centimetre (one-foot) high obstacle and traversed a 1.5-metre (five-foot) ditch.

Enthusiasm grew for the potential of Little Willie, spurring the go-ahead for a larger prototype, dubbed “Big Willie” or “Mother”. Substantially longer than Little Willie, Mother included sponsons on each flank to support 15-centimetre naval guns. In trials at Hatfield Park in January 1916, Mother demonstrated the benefit of a lower centre of gravity, crossing a trench that was 2.7 metres (nine feet) wide and climbing a berm that was 1.9 metres (6.5 feet) high. Although there were obvious omissions, including an adequate suspension system to absorb the continual shock of cross-country movement, the designers were pleased.

A month later, a group of dignitaries, office holders and high-ranking military men were invited to a demonstration. As Mother was

put through its paces, Lord Kitchener scoffed that the vehicle was a “mechanical toy” and a war would “never be won by such machines”. But Chancellor of the Exchequer Reginald McKenna and Minister of Munitions David Lloyd George were impressed. An order was placed for 100 vehicles, and the type was designated the Mark I.

When Mother entered production, every effort was made to maintain secrecy, and the word was intentionally spread that the massive objects being assembled were water tanks. The word “tank” stuck, and some historians believe that it had been suggested by none other than Lieutenant Colonel Swinton.

As it came off the assembly line, the Mark I tank weighed 31 tons, required a crew of eight soldiers and was protected by riveted armour plate. Two main variants were completed. The “Male” tank was armed with sponson-mounted six-pounder guns along with a pair of 7.7mm Hotchkiss or Lewis machine guns mounted at either side of the hull. The “Female” variant was armed solely with 7.7mm machine guns, five or six as the situation dictated. The former was intended to subdue enemy strongpoints with its cannon, while the latter would be deployed as an anti-infantry weapon.

The Mark I received the honour of making the combat debut of the tank on the modern battlefield at Flers-Courcelette in 1916. From the outset, an effort to improve the design was underway. The Mark I had been prone to mechanical failure, and its 105-horsepower Daimler-Knight engine made it a slow-moving target. On the battlefield it was particularly susceptible to becoming immobilised in shell holes or deep trenches. Subsequently, the

Mark II and Mark III were produced in limited numbers for training purposes, and the Mark IV, a substantial improvement, became the primary British tank of the Great War. A total of 1,220 Mark IV tanks were produced during the war, and the later Mark V was even better.

Meanwhile, Tritton reasoned that a light, fast tank might be useful in the exploitation of any breach in enemy lines achieved by the heavier tanks and supporting infantry. He designed the Tritton Chaser, which he later christened the “Whippet”, and with it a new dimension of tactical armoured warfare dawned.

Amid British progress, other European military establishments also awakened to the potential for the armoured fighting vehicle. In France, General Jean Baptiste Eugène Estienne earned the sobriquet “father of the tank”. He championed the development of the Schneider CA 1, while rivals Colonel Émile Raimailho and government official Jules-Louis Breton designed the Saint-Chamond. However, the Renault FT-17 light tank, with its 360-degree rotating turret, should probably be considered the best tank of the Great War.

The U.S. Army formed a tank corps in late 1917 and bought some FT-17s from France. Tank development in the U.S. was not earnestly undertaken until after the country entered WWI. In Germany, experimentation with the light LK I and LK II tanks occurred in the spring of 1917. However, the only German tank to reach the battlefield was an ungainly behemoth called the A7V.

Although tank warfare was in its infancy, the stage had been set for rapid technological advancement and the furtherance of a revolutionary weapon of future land battles.

MARK I

The first tank to ever see battle changed conflict forever, helping eliminate the stalemate of trench warfare

ARMOUR

One of the Mark I's biggest flaws was its structure. The armour was bulletproof but was prone to splitting the projectiles fired at the tank into shrapnel, which could injure the crew. In early models the tank crew were compelled to wear chain mail!

CREW

An eight-man crew would work inside a Mark I tank. Effective teamwork was difficult as the lack of light meant during battle the interior was in almost complete darkness. The excruciating noise meant that tactics and strategy were often incoherent.

Only 250 of these metal monsters were created and even less saw battle on the muddy Western Front, but the Mark I signalled the dawn of a new type of warfare. With the stalemate of the trenches wearing down both sides in WWI, the tank was designed to be used as an armoured battering ram that could tear down enemy fortifications.

'Male' tanks were armed with three machine guns and one quarter-pounder gun, while the lighter 'female' versions contained six machine guns but less armour. The guns on the sides of this behemoth would mow down any infantry that would dare cross its path – at least that was the theory. In its first few engagements the Mark I regularly overheated and broke

down, and many were captured by the Imperial German Army. Conditions inside the tank were almost unbearable, with temperatures reaching 50 degrees Celsius (122 degrees Fahrenheit) and the loud machinery almost deafening. The potential was seen in the Mark I though, so later versions of the tank would succeed where it failed.

After small advances in the II and III, the Mark IV was a vastly improved machine. Containing much thicker armour and a better engine, this would have the greatest impact on the Western Front, with its successor only available in the latter stages of the war. The tank became the new cavalry of the battlefield, and the various 'Mark' models played a big

DESIGN

An unusual shape enabled the tracks of the tanks to be as long as possible. The prototype for the Mark I, Little Willie, was deemed neither long nor strong enough to tackle trenches, so a rhombus was deemed effective.

ENGINE

The engine of choice in the tank was a water-cooled 105hp. Due to the vehicle's bulk, this power was simply not enough and the Mark I was often reduced to a crawl as it was overtaken by infantry.

WHEELS AND ROOF

Unlike later models, the Mark I had both extra wheels and a sloped roof. The wheels were intended to aid steering, while the roof could deflect grenades. Both of these features were quickly phased out in later models.

HEAVY TANKS OF THE GREAT WAR FROM THE MARK I TO THE MARK X

1915 'Little Willie' is tested as the first prototype of the Mark I – precursor to all tanks.	April 1916 150 Mark I tanks are ordered to be built for the war in the trenches.	August 1916 The first batch of Mark I tanks make their debut just in time for the Somme offensive.	March 1917 The first Mark II tanks enter the fray, ready made with improvements on the original model.	May 1917 The vastly improved Mark IV is introduced onto the Western Front after the Mark III is used purely for training purposes.	July 1917 The new Mark VII is born after co-development with the U.S. The VI had previously been cancelled after disagreements arose during production.	November 1917 476 tanks do battle at Cambrai and make significant advances into German territory across the Hindenburg Line.	April 1918 The first-ever tank-to-tank battle sees Mark IVs combat German A7Vs.	September 1918 The Mark VIII is created after a joint project between the U.S., Britain and France and remains in use until 1934.	1919 The last two 'Mark' models are created, with the IX a troop carrier. The X never makes it off the production line.
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part in the emergence of tank dominance. The Mark IX was the final tank of the line to be built, but the design was still used after the Great War.

Mark Vs were used by both sides in the Russian Civil War and two were even found in the Battle of Berlin in the last days of the Third Reich. Although initially unreliable, these tanks were pioneers for modern warfare. During the Battle of Kursk in 1943 over 6,000 tanks duked it out on the battlefield. The Nazi blitzkrieg would have stalled without them, and during the post-World War years, tanks still play a major part in conflicts across the globe – the Mark I is where they all began.

By ferrying troops in and out of battle in rapid succession, the Bell UH-1 Iroquois revolutionised warfare



IN ACTION
THE BATTLE OF CAMBRAI
GIANT STEPS IN CATERPILLAR TRACKS

By late 1917 the First World War had reached a stalemate. The British had been unable to break through the German lines in the West. The only place where the British had made a significant advance was in the East, where they had captured the town of Cambrai. The British had used a new type of tank, the Mark IV, to break through the German lines. The Mark IV was a large, heavy tank with a turret and a main gun. It was the first tank to have a turret. The British had used the Mark IV to break through the German lines at Cambrai. The Mark IV was a significant improvement on the Mark I. It was larger, heavier, and had a turret. The Mark IV was the first tank to have a turret. The British had used the Mark IV to break through the German lines at Cambrai. The Mark IV was a significant improvement on the Mark I. It was larger, heavier, and had a turret. The Mark IV was the first tank to have a turret.

“TANKS STILL PLAY A MAJOR PART IN CONFLICTS ACROSS THE GLOBE – THE MARK I IS WHERE THEY ALL BEGAN”



THE TANK TAKES THE FIELD

With a forboding metallic rattle, the first tanks destined for war rolled onto the churned fields of the Somme in 1916

WORDS MICHAEL E. HASKEW

The very nature of warfare changed forever on 15 September 1916 with the debut of the tank at the Battle of Flers-Courcelette during an Allied offensive on the Somme. The Great War was moving towards its third year, and Allied grand strategy envisioned a concerted effort to breach the German lines along the axis where the French and British armies met in Picardy, near the River Somme.

However, the German offensive at Verdun altered the Allied plan as the French were required to transfer reinforcements to the south. The Somme offensive was subsequently modified into an effort to relieve mounting pressure on the French defending Verdun. In the event, the Somme offensive itself became one of the bloodiest military encounters in history, and after more than four months it had ground to a stalemate.

The Battle of Flers-Courcelette was intended to break the stalemate on the Somme, and

the tank, a new and untried weapon of war, was seen as the sledgehammer that might shatter the enemy's strong line of resistance. In preparation for the mid-September assault, the British moved 49 Mark I tanks to assembly areas, and following a preparatory artillery barrage they were ordered to advance in sections of two or three.

Movement to the start line had been a challenge in itself as mechanical breakdowns reduced the number of Mark Is to 36. The artillery bombardment was directed to preserve lanes of approach and thereby avoid creating shell holes that might impede the progress of the armour, while British officers realised that the tanks would draw German fire and ordered accompanying infantry to advance some distance behind the leading machines.

In the opening minutes of the main assault 14 British tanks were lost to mechanical failures or immobilised by battlefield obstacles. Only 18 of the Mark I tanks actually

reached the German lines, with nine staying in the fight long enough to attack enemy positions. German machine guns opened fire and bullets clanked off the armoured skins. Inside the tanks temperatures soared and the heavy growl of the engines and exhaust fumes made conditions extremely difficult.

Private J. L. Addy of the Tank Corps later commented, "When you're enclosed in a tank and there's that much racket, you don't know whether it's shells that's hitting you or what you're doing. The noise of the engine was tremendous, and we had to stand by with a pyrene fire-extinguisher and get ready to shoot it at the engine if it got too hot, because we had 20 gallons of petrol on either side of the tank and all round the sides there were racks of ammunition..."

The rear-drive mechanism on one tank was hit by shrapnel, causing a loss of control, and the machine eventually careened into a shell hole. Another was immobilised when its tracks



The remains of the main street in Flers



loosened and fell off the caterpillar machinery. Nevertheless, the tanks had an immediate impact, causing many German defenders to take to their heels.

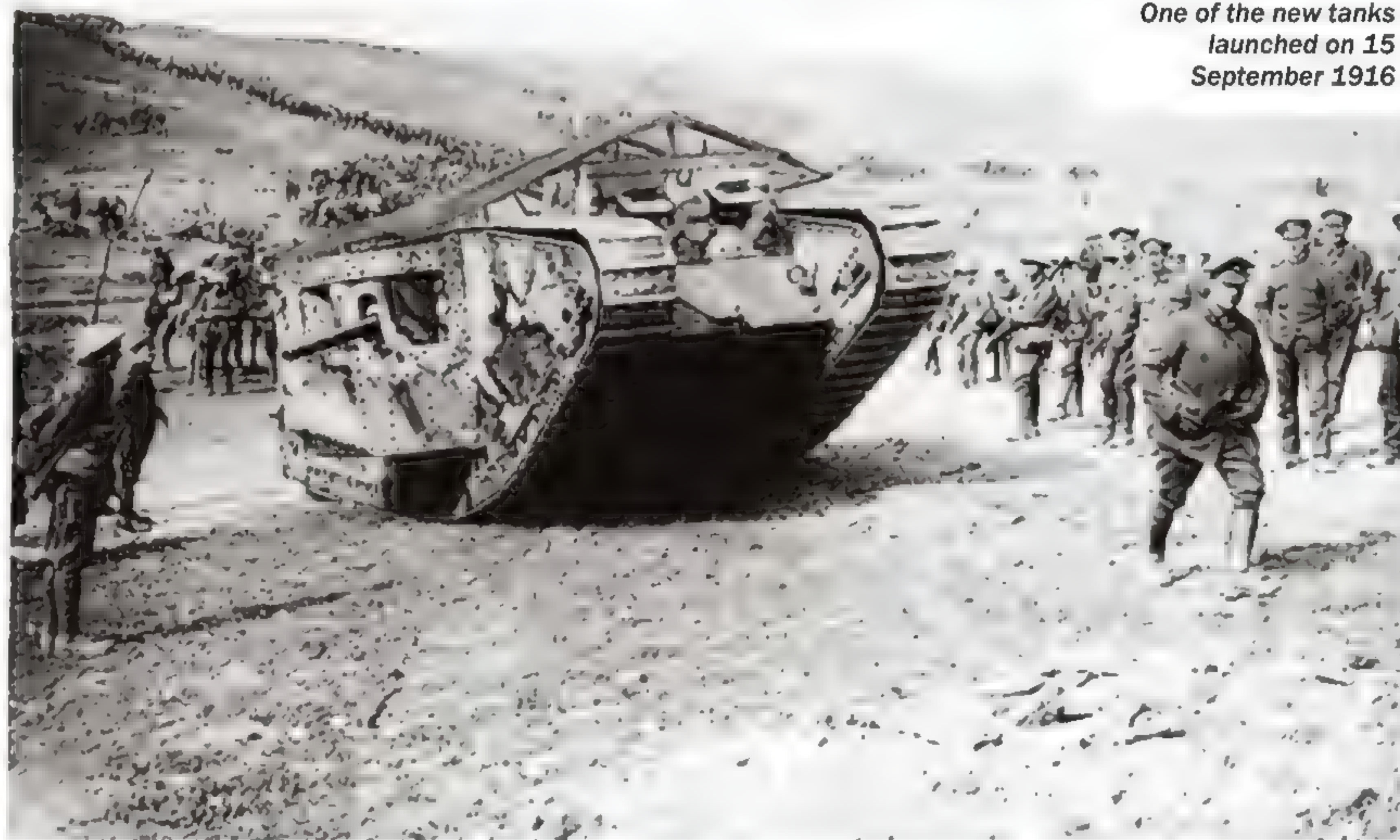
One British soldier later observed of the tanks' impact, "...the moral effect on Fritz the first time we went into action was undoubted".

The tank attack at Fliers-Courcelette was hailed in the press. A reporter for the *London Daily Chronicle* crowed, "Over our own trenches in the twilight of the dawn one of those motor-monsters had lurched up, and now it came forward to the rescue, cheered by the assaulting troops who called out words of encouragement to it and laughed, so that some men were laughing even when bullets caught them in the throat. 'Crème de Menthe' was the name given to this particular creature, and it waddled forward right over the old German trenches. There was a whip of silence from the enemy. Then, suddenly, their machine-gun fire burst out in nervous spasms and splashed the sides of 'Crème de Menthe.' But the tank did not mind. The bullets fell from its side harmlessly. From its sides came flashes of fire and a hose of bullets."

The tanks proved vulnerable at times to German machine-gun and artillery fire that was loosed as a response to their advance, but there could be absolutely no doubt that the armour was a viable weapon of war. Despite the setbacks, the tanks did breach the enemy line, rolling across barbed wire obstructions and clearing shallow trenches and depressions to silence German machine gun nests and shoot down enemy infantrymen. Still, some of them were lost in craters or became stuck in ditches and trenches that proved too deep and wide to traverse.

The tanks remained in action for three days and advanced about a mile. Although the ground gained did not constitute a major breakthrough, the results were encouraging enough to convince senior Allied officers to continue the development of armour. The Germans, too, would respond in time.

One of the new tanks launched on 15 September 1916



British troops pick their way across the Somme



MEDIUM MARK A WHIPPET TANK

The Medium Mark A Whippet tank complemented heavier British tanks with battlefield speed & firepower

WORDS MIKE E. HASKEW

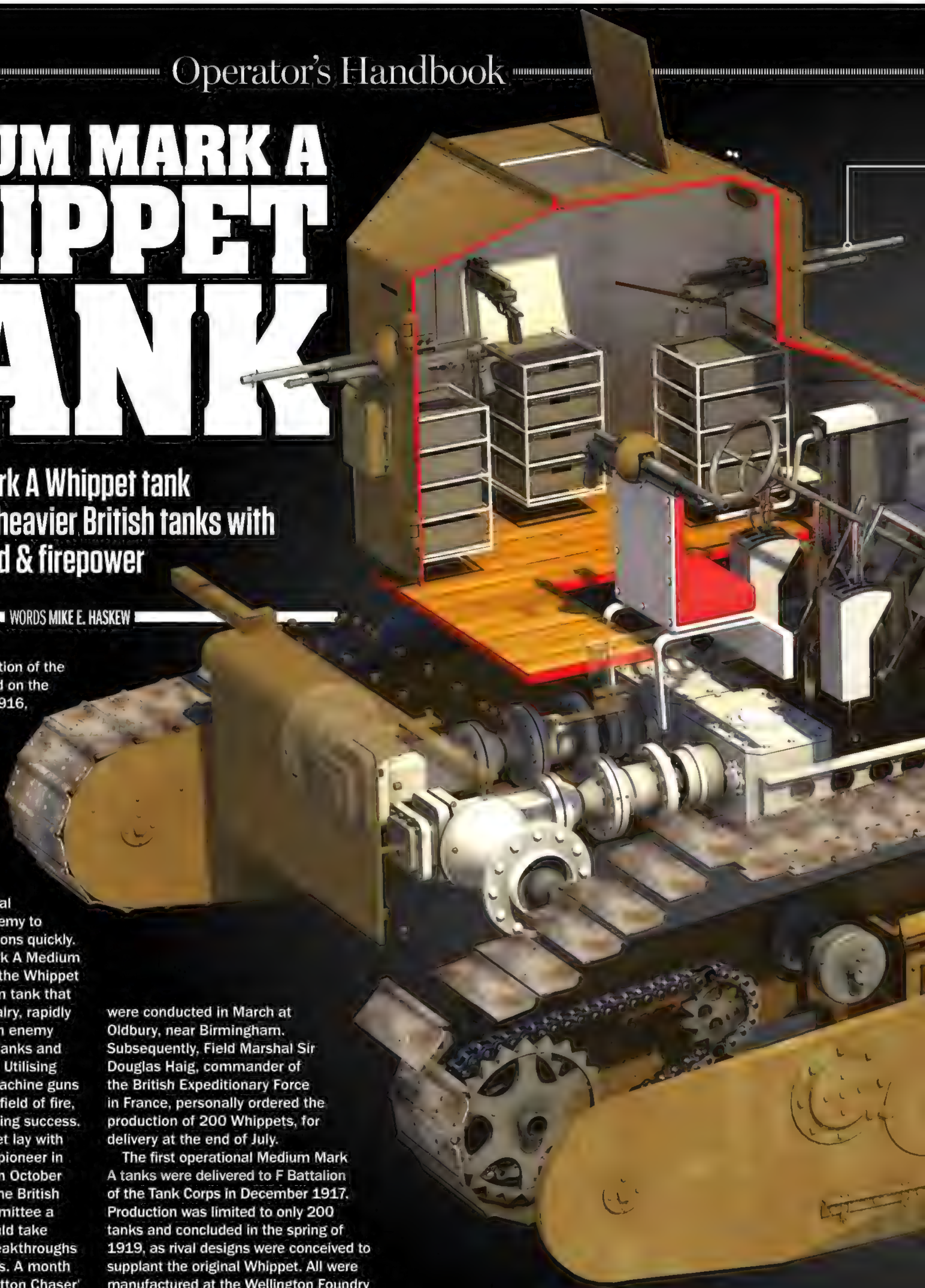
Following the introduction of the tank to the battlefield on the Somme in autumn 1916, British tacticians realised that the armoured vehicles might indeed breach German lines and end the stalemate on the Western Front in WWI. However, due to their slow speed and ponderous weight, their heavy Mark I, IV and V tanks were incapable of rapidly exploiting any initial gains, which allowed the enemy to re-establish defensive positions quickly.

The solution was the Mark A Medium Whippet. In relative terms, the Whippet was conceived as a medium tank that operated as battlefield cavalry, rapidly pouring through breaches in enemy lines created by the heavy tanks and sowing chaos in rear areas. Utilising speed and four mounted machine guns that covered a 360-degree field of fire, the Whippet was a resounding success.

The origins of the Whippet lay with engineer William Tritton, a pioneer in British tank development. In October 1916, Tritton proposed to the British military's Tank Supply Committee a lighter, faster tank that would take advantage of battlefield breakthroughs achieved by the heavy tanks. A month later, the concept of the 'Tritton Chaser' was approved. The prototype was ready by the following spring and field trials

were conducted in March at Oldbury, near Birmingham. Subsequently, Field Marshal Sir Douglas Haig, commander of the British Expeditionary Force in France, personally ordered the production of 200 Whippets, for delivery at the end of July.

The first operational Medium Mark A tanks were delivered to F Battalion of the Tank Corps in December 1917. Production was limited to only 200 tanks and concluded in the spring of 1919, as rival designs were conceived to supplant the original Whippet. All were manufactured at the Wellington Foundry of William Foster and Co. Ltd. in the East Midlands city of Lincoln.



HOTCHKISS MACHINE GUNS

Four French-designed Hotchkiss light machine guns provided excellent firepower against enemy troops as the Whippet advanced rapidly through breaches in German trench lines.

DISTINCTIVE TURRET

The distinctive turret of the Whippet made it easily identifiable on the battlefield and gave its crew reasonably good visibility. However, it was also a target for enemy artillery.

TRACKS

The tracks of the Whippet were covered with mud chutes to reduce the possibility of the tank becoming mired in the sludge of the Western Front battlegrounds.

TYLOR ENGINES

A pair of four-cylinder, side-valve JB4 petrol engines gave the Whippet a remarkable top speed of 13.4kph (8.3mph), generating 90hp.

“BRITISH TACTICIANS REALISED THAT THE ARMoured VEHICLES MIGHT INDEED BREACH GERMAN LINES AND END THE STALEMATE ON THE WESTERN FRONT IN WWI”

WHIPPET

COMMISSIONED: 1917

WEIGHT: 14 TONS

RANGE: 130KM (80MI)

CREW: 3

ENGINE: 2 X TYLOR TWIN 4-CYLINDER, SIDE-VALVE JB4 PETROL

ARMOUR: 14MM

PRIMARY WEAPON: 125MM SMOOTHBORE 2A46M CANNON

SECONDARY WEAPON: 4X HOTCHKISS MACHINE GUNS



British crewmen pose atop the turret of a Whippet during exercises. The tank proved a valuable asset as the Allies attempted to break the stalemate on the Western Front

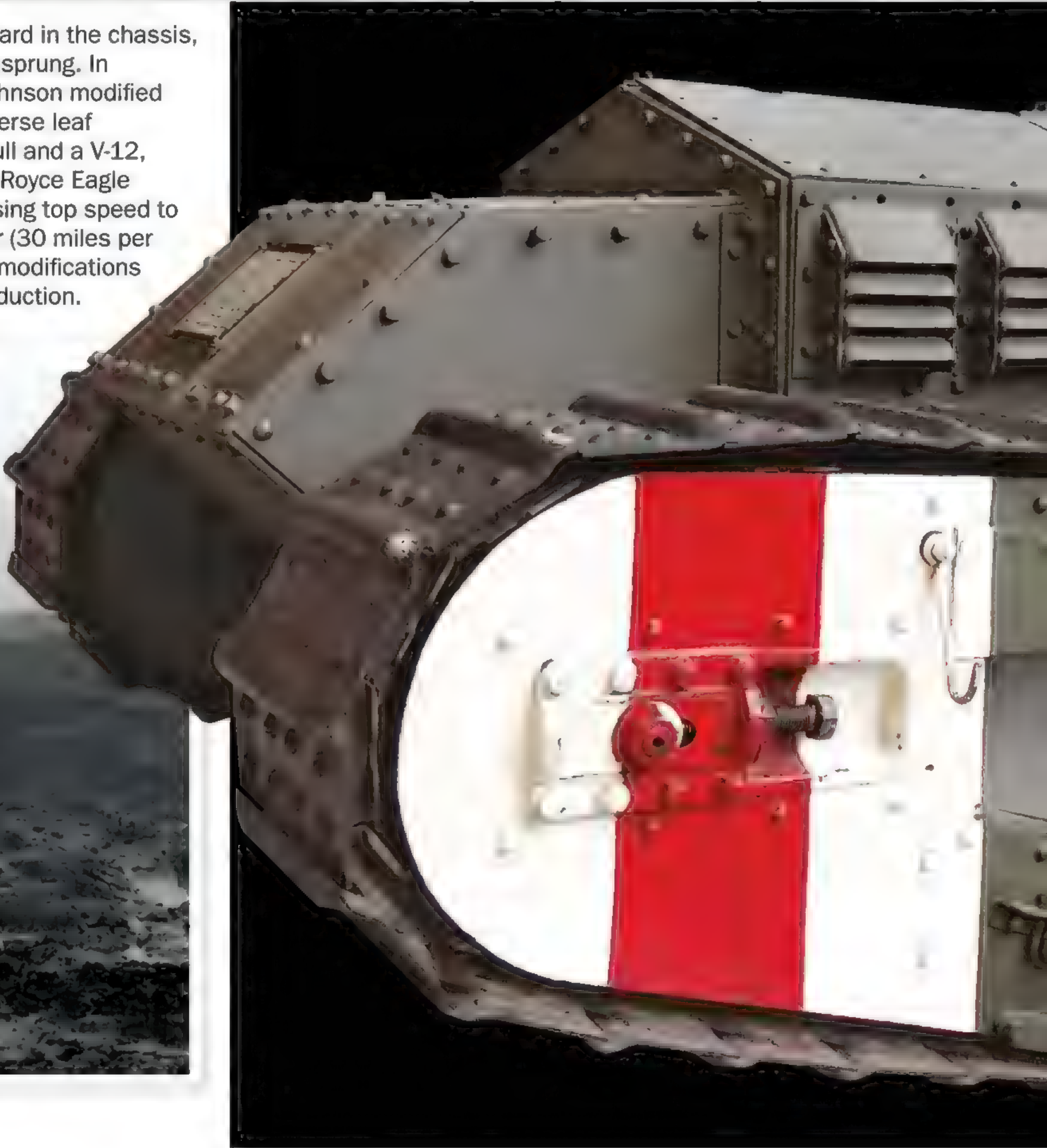
DESIGN

The Whippet design included shorter tracks, which dispelled the belief that the tracks had to be as long as the hull in order to ensure maximum capability to exit shell holes or traverse trenches. Sizable mud chutes along the flanks and rear channelled mud away from the rollers and tracks, improving mobility.

The fuel tank was forward in the chassis, which was originally unsprung. In 1918 Colonel Philip Johnson modified a Whippet, adding traverse leaf springs beneath the hull and a V-12, 360-horsepower Rolls-Royce Eagle aircraft engine, increasing top speed to 48 kilometres per hour (30 miles per hour). However, these modifications were too costly for production.



This Whippet demonstrates the tank's capability to traverse a muddy landscape. The Whippet employed shorter tracks than other tanks improving earlier designs



Soldiers relax by their Whippet tank somewhere near the frontlines. The tank fulfilled its mission of exploiting breaches in enemy defences with rapid mobility



The Whippet stood high off the ground, its squared turret constructed of riveted plates to provide protection against small-arms fire



"THE GUNS WERE REMOVABLE FROM THEIR INTERNAL MOUNTS"

The Whippet became a distinctive sight on the battlefield, with its turret at the rear of the chassis and twin engines forward of the crew compartment



ARMAMENT

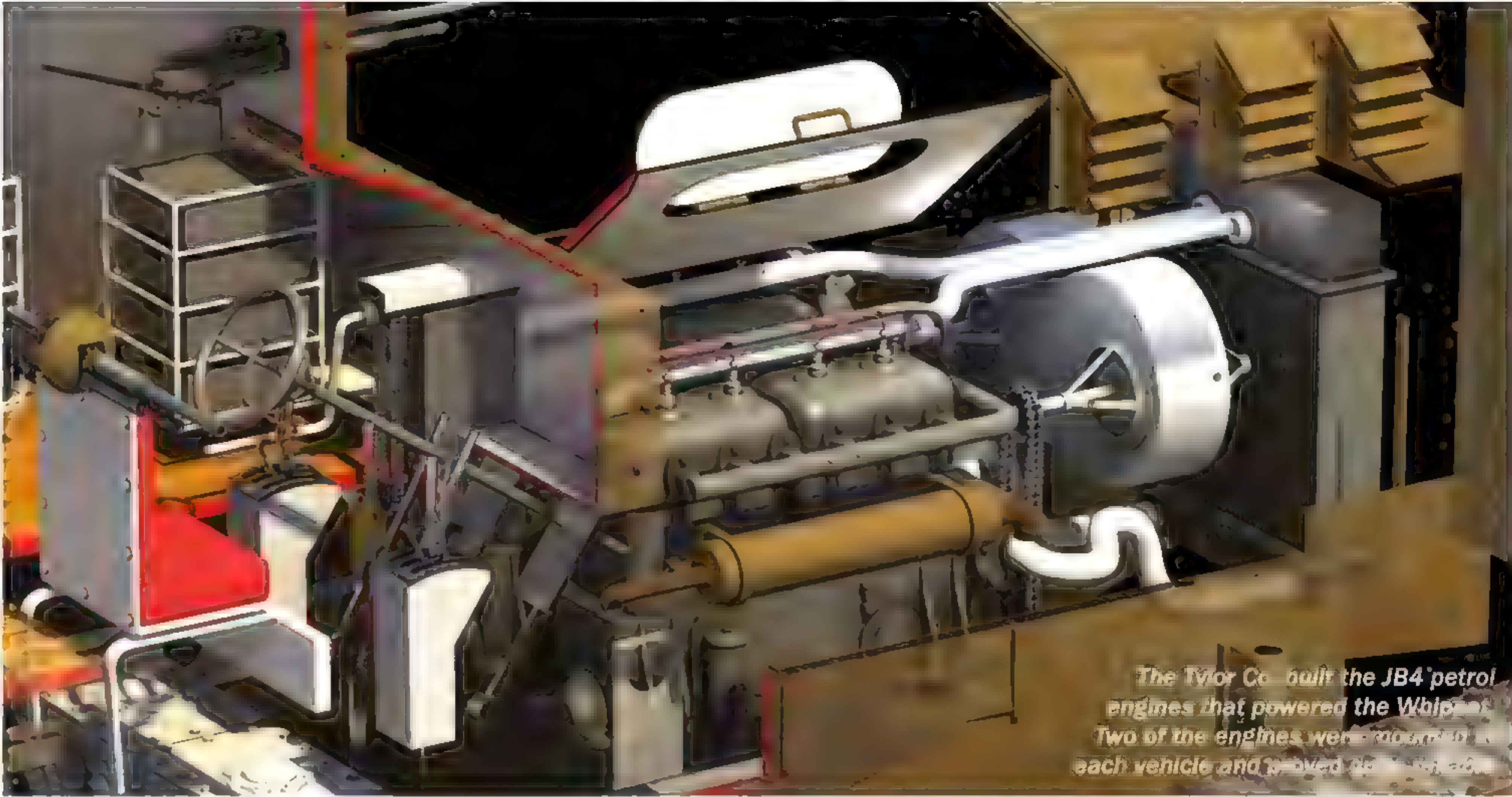
The light Hotchkiss M1909 machine gun was manufactured in Britain with the label 'Mark I', and 40,000 were completed. The Medium Mark A Whippet was armed with four of the .303-calibre weapons, with a maximum range of 3,800 metres (4,160 yards) and a rate of fire of up to 600 rounds per minute. The Hotchkiss was gas-operated and air-cooled. Fed by a 30-round strip initially and later by belt, it was sometimes prone to jamming, and parts were difficult to replace. The guns were removable from their internal mounts, and occasionally a fourth crewman was aboard the Whippet to operate one or more of the weapons.

Four French-designed Hotchkiss .303-calibre machine guns, manufactured under licence in Britain as the Mark I, were installed aboard the Whippet

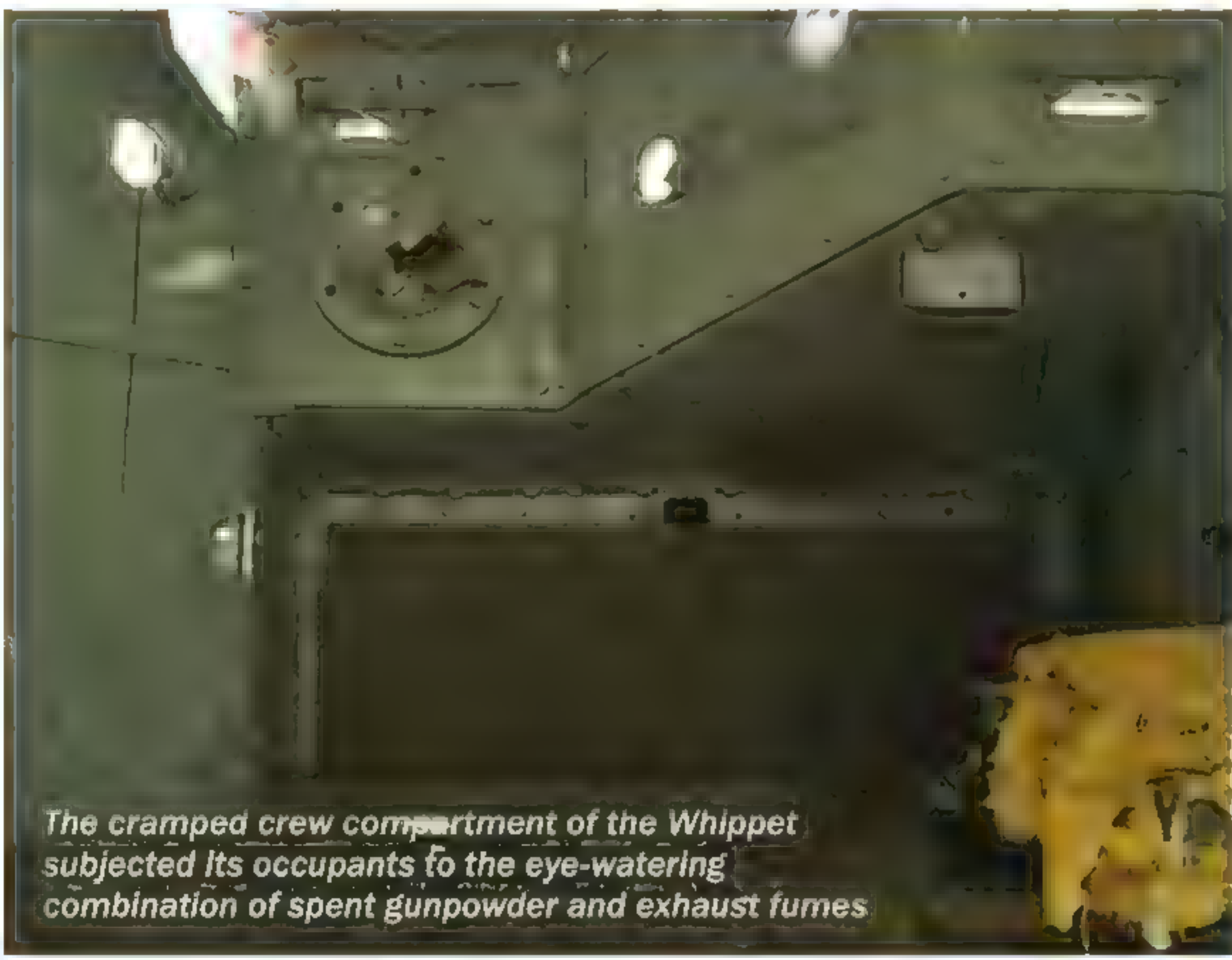


ENGINE

The Tylor Co. traced its origins to the mid-18th century. Its twin four-cylinder, side-valve JB4 petrol engines powered the Medium Mark A Whippet, generating a combined 90 horsepower and a top speed of 13.4 kilometres per hour (8.3 miles per hour). The Whippet's performance was more robust than heavier tanks, particularly considering its comparable weight of 14 tons. The Tylor JB4 engine was similar to those that powered the double-decker buses through the streets of London, and each engine was paired with one of the Whippet's tracks. A complex steering system controlled the throttles of each engine, allowing the driver to execute turns.



The Tylor Co. built the JB4 petrol engines that powered the Whippet. Two of the engines were mounted in each vehicle and powered the tracks.



The cramped crew compartment of the Whippet subjected its occupants to the eye-watering combination of spent gunpowder and exhaust fumes.

CREW COMPARTMENT

Only two crew members could fit inside the Whippet's cramped compartment. The driver sat in the front, and the gunner sat behind him. The compartment was so small that the crew had to sit on the floor. The gunner's position was particularly cramped, as he had to sit on a small stool. The driver's position was also cramped, as he had to sit on a small stool. The compartment was so small that the crew had to sit on the floor. The gunner's position was particularly cramped, as he had to sit on a small stool. The driver's position was also cramped, as he had to sit on a small stool.

"COMBINED WITH THE ACRID ODOUR OF GUNPOWDER, THE NOXIOUS FUMES WERE CAPABLE OF INCAPACITATING CREWMEN AT TIMES"



A Whippet sits idle on the Western Front while a crewman reclines adjacent to the turret.

This artist's rendering depicts the impact of the Whippet on the battlefield, grinding across barbed-wire obstacles while ruthlessly shooting down panicked Germans



SERVICE HISTORY

THE MEDIUM MARK A WHIPPET WAS A BATTLEFIELD SUCCESS, ALTHOUGH IT WAS DEPLOYED IN LIMITED NUMBERS

The Whippet reached the battlefield in early 1918, and its crews first experienced combat during the German spring offensive. The Whippets blunted enemy attacks by covering the withdrawal of British troops, enabling them to re-establish defensive lines. At Hébuterne, in northern France, a dozen Whippets caught two battalions of German soldiers on the move and forced them to retire.

Once the crisis had passed, the Whippets were assigned to tank battalions in company strength. On 24 April 1918, seven Medium Mark A Whippets rushed to the aid of a Mark IV heavy tank just exiting a fight with three German A7V tanks. The Whippets then caught several battalions of German infantry in the open and shredded them with relentless machine-gun fire. Some enemy soldiers were crushed under Whippet treads. Approximately 400 Germans were killed. Three Whippets survived the struggle. Later in the day, a Whippet was destroyed by an A7V.

The most memorable wartime Whippet exploit belonged to the crew of 'Musical Box', which terrorised the enemy for nearly 11 hours on 18 August 1918. Commanded by Lieutenant C.B. Arnold, Musical Box dashed through a breach in the enemy line and destroyed a German artillery battery. Unable to retire, Musical Box proceeded to opportunistically hunt targets, attacking enemy columns and supply convoys, ramming a German truck and pushing it into a stream, and machine-gunning an airfield and destroying an observation balloon.

German bullets penetrated Musical Box's thin armour and pierced the petrol tank, forcing the crew to put on gas masks. When an artillery shell rocked the tank and set leaking fuel afire, the crew had no choice but to abandon the Whippet. One crew member was shot dead, while Arnold and the other crewman were taken prisoner.

After the war the British deployed the Whippet in Ireland during the Irish War of Independence (1919–1921) and the Russian Civil War, and several tanks were sold to Japan. It remained in service into the 1930s.

An American captain and his gunner sit inside a Whippet tank



Below: Whippet tank crewmen await orders to move forward into action on the Western Front



RENAULT FT-17

The French-built Renault FT-17 introduced design concepts that remain universal in the construction of tanks to this day

The outbreak of WWI energised the development of tanks in France, and two heavy machines, the Saint-Chamond and Schneider CA 1, were introduced. The French military establishment was following Britain's lead, with ponderous tanks mounting multiple large-calibre weapons and machine guns operated by a number of crewmen. General Jean Baptiste Eugène Estienne, remembered today as the "father of the tank" in the French Army, also envisioned the tank as a mobile "strike" weapon.

Estienne approached automaker Louis Renault, requesting the development of a light tank prototype. At first Renault declined, but Estienne persisted. By the summer of 1916 the automaker was developing a tank that would revolutionise armoured fighting vehicle design for generations. Renault may actually have been working on a light tank prior to Estienne's entreaties, as the prototype FT-17 entered production shortly after Renault acquiesced.

The FT-17 introduced innovative design elements that continue to influence modern tank development. The tank incorporated a turret capable of 360-degree traverse, allowing the vehicle to reorient its main weapon and fire in any direction. Firepower was also concentrated toward the vehicle's front with supporting machine guns placed forward.

To increase crew space, the engine was located at the rear of the FT-17, reducing the potential of a devastating fire in the crew compartment and adding weight to the rear, providing greater traction. Armed with a 37mm Puteaux SA 18 main gun and either a single or pair of Hotchkiss 8mm machine guns, the FT-17 was operated by a two-man crew. Its four-cylinder Renault petrol engine generated a top speed of 7.7 kilometres (5.5 miles) per hour. The first FT-17s reached the French Army in late 1917, and the tank made its combat debut at Chaudun on 31 May 1918, during the Second Battle of the Marne.

The performance of the FT-17 was obviously superior to other tank designs. Although it was continually plagued by radiator issues, nearly 2,700 were completed by the end of WWI. Its service life extended for three decades. The United States purchased a quantity of FT-17s and produced nearly 1,000 under licence.

TRACK CONFIGURATION

A large forward idler wheel was fitted to each track to improve the FT-17's ability to negotiate battlefield hazards such as shell holes and to climb over obstacles that would otherwise impede its progress.

TURRET

The FT-17 was constructed without an actual chassis. Components were attached or riveted directly to the tank's hull, which was constructed with steel plating. Specifications called for the entire tank to weigh less than seven tons.



ROTATING TURRET

The 360-degree rotating turret mounted atop the hull of the French Renault FT-17 light tank redefined the battlefield capabilities of the weapons system, allowing the armoured vehicle to fire in any direction.

An FT-17 rolls along a cobbled street in the Rhineland, Germany, 1919



ENGINE PLACEMENT

The four-cylinder Renault petrol engine of the FT-17 light tank was placed at the rear of the vehicle to reduce the potential of a catastrophic fire in the crew compartment and focus weight to the rear for greater traction.



RENAULT FT-17

COMMISSIONED: 1916

WEIGHT: 6.4 TONS

RANGE: 60KM (37MI)

CREW: 2

ENGINE: FOUR-CYLINDER RENAULT PETROL ENGINE (156HP)

ARMOUR: 8-22MM

PRIMARY WEAPON: 37MM PUTEAUX SA 1918 GUN

SECONDARY WEAPON: 8MM HOTCHKISS MACHINE GUN

WORDS JOHN A. TAYLOR

CAMBRAI: DAWN OF THE TANK AGE

In 1917 the British Army launched its latest though as-yet unproven battlefield technology in a bid to break the static face-off on the Western Front. But was it the overwhelming success generals had hoped for?

"IT WAS THE START OF THE BATTLE OF CAMBRAI, PERHAPS THE MOST EXTRAORDINARY OPERATION OF WWI, AND ONE THAT WOULD ULTIMATELY CHANGE WARFARE FOREVER"

At 6 a.m. on 20 November 1917 the men of 84 Infanterie-Regiment were slumbering in their dugouts, secure in the knowledge that they occupied the most formidable German positions on the entire Western Front. It was a sector so quiet that troops called it the 'silent front' or the 'Flanders sanatorium', where divisions were sent to recover from the slaughter unfolding in the Ypres Salient.

In such a peaceful place it should have been impossible for the enemy to conceal any preparations for an attack. Yet at 6.20 a.m. the calm was shattered by a stupendous artillery bombardment that erupted without warning on the German lines. Leutnant Adolf Saucke raced to the entrance of his dugout. "In the dawn, the trench was like a sea of fire from the ceaseless detonation of falling shells," he later described.

When the barrage moved forward, they rushed out to man the trenches but could see nothing: "In front of us, no-man's land was cloaked in grey morning mist. Behind us lay a greyish-yellow wall of fog, from which emerged dazzling flashes of flame from the constantly bursting shells."

Ahead in no-man's land lay a network of advanced outposts designed to detect and disrupt an attack. Peering into the mist from one of these positions, Leutnant Adolf Mestwarb heard an astonished cry: "Sir, something square is coming!" As it lumbered forward, Mestwarb recognised the angular form of a British tank but with an enormous object perched on its roof. "We immediately opened fire, but unfortunately without making the slightest impression on the brute. It moved further forward, firing as it went, then veered to the left to make room for those behind, which were now appearing one after another from behind the wood in front of us."

As they were driven back by fire from the tanks and from low-flying aircraft, Leutnant Mestwarb had no idea that the same story was being repeated along ten kilometres (six miles) of the German front. A total of 378 fighting tanks, supported by six divisions of infantry, were surging forwards, preceded by a hurricane of artillery fire. Each tank bore an enormous bundle of brushwood known as a 'fascine' designed to be dropped into the German trenches as a kind of stepping-stone, allowing itself and others to cross.

Astonishing as it seems, all these tanks and infantry had been secretly moved into position, along with 1,000 field guns and the entire Cavalry Corps, ready to exploit a breakthrough, without the Germans having any idea of the scale of the offensive that was about to be unleashed upon them.

Most astonishing of all, the attack was being launched not against some weak point in the German defences but against a massive and seemingly impregnable trench system known to the British as the Hindenburg Line and to the Germans as the Siegfriedstellung. The name was symbolic, because Siegfried was the greatest hero of Norse mythology – a young man who did not know the meaning of fear.

It was the start of the Battle of Cambrai, perhaps the most extraordinary operation of WWI and one that would ultimately change the conduct of warfare forever.

LUST OF BATTLE

Despite weeks of planning and preparation, the attack was a journey into the unknown for the crewmen sealed inside their 28-ton machines as they lumbered across no-man’s land at six kilometres (four miles) per hour.

They had no idea if their tanks could penetrate the dense belts of barbed wire and pave a path that the infantry would be able to follow; no idea if their fascines would bridge the gulf of the German trenches; and no idea if the barrage, fired from unregistered field guns, would destroy its targets – particularly the enemy artillery known to be waiting ahead, which posed the only real threat to the tanks.

“AS FAST AS THE GUNNERS COULD RELOAD, THEY POURED IN A HAIL OF BULLETS, TOSH HIMSELF FIRING AND YELLING LIKE A MANIAC. AT LAST THE PANIC SUBSIDED, THE REMAINDER OF THE ENEMY APPARENTLY REALISING THE FUTILITY OF AN ATTEMPT TO ESCAPE”

One of the machines bearing down on the men of 84 Infanterie-Regiment was D27 Double Dee III, commanded by Second Lieutenant Horace Birks.

“Emerging out of the gloom a dark mass came steadily towards us: the German wire. It appeared absolutely impenetrable... It neither stopped the tank nor broke up and wound round and round with the tracks as we at first feared, but it squashed flat and remained flat, leaving a broad carpet of wire as wide as the tank, over which the following infantry were able to pick their way without great difficulty... It was a relief to get through the wire and come out on to the main German position. All this time there had been no firing and very little shell fire, and the tanks on the right and left could be seen keeping station with us,” he recalled later.

So far so good, but they then had their first view of the enormous German trenches, which

had been dug up to 3.5 metres (11.5 feet) wide to act as anti-tank obstacles. Advancing to the right of Birks’ tank was E45 Elles II, commanded by Second Lieutenant Fred Dawson. “First, poised over the deep and wide excavation: then, releasing the fascine – would it drop all right? We saw it lumber beautifully into the bottom. But could we get over? One can imagine our doubts... Anyhow, down we dropped and up, up, up – no one thought of the ‘balance point’ – until at last we crashed upon the other side, splitting open my section commander’s head, and petrol cans and ammunition boxes scattered all over the place.”

Once safely across, the tank crews encountered varying levels of resistance depending on the fighting qualities of the units facing them. A battalion commander in 84 Infanterie-Regiment, Hauptmann Harro Soltau, told his staff, “A Prussian officer does



A tank from G Battalion passes captured field guns as the advance continues towards Bourlon on 23 November



DIMENSIONS

LENGTH: 8.1m (26.5ft)
WIDTH: Male tank (shown) 3.9m (13ft); Female tank 3.2m (10.6ft)
HEIGHT: 2.5m (8.2ft)
FIGHTING WEIGHT: 28 tons
MAXIMUM ARMOUR THICKNESS: 12mm (0.5in)
MAXIMUM TRENCH CROSSING: 3m (10ft)

CREW COMPARTMENT

EIGHT-MAN CREW:
Commander (junior officer)
Driver (normally NCO)
Four Gunners (in side sponsons)
Two Gearsmen (at rear of tank)

SPONSONS

MALE TANK (SHOWN): Door in rear provides main entry/exit for crew. Sponson slides into tank body when transported by rail.
FEMALE TANK: Sponson narrower, openings underneath provide main entry/exit for crew.

ARMAMENT

EACH SPONSON CONTAINS:
MALE TANK (SHOWN): Six-pounder, 23-calibre Hotchkiss quick-firing (QF) gun, adapted from naval gun but with shorter barrel. Fires solid shot, high explosive and case shot.
MAXIMUM EFFECTIVE RANGE: 6.7km (4.2mi)
Also one Lewis gun – air-cooled drum-fed .303 light machine gun.
FEMALE TANK: Two Lewis guns.
Additional Lewis gun at front for commander.

not retreat,” and sent a final message to regimental headquarters: “We will hold on till the last man.” Other attackers came up against older Landwehr troops and found the biggest challenge was pressing forward as hundreds of men surrendered. But all resistance was swept aside, whether the Germans gave up, fled or fought to the death like Soltau and his men.

In his tank D45 Destroyer II, Lieutenant James Macintosh (who referred to himself as ‘Tosh’) described how men of the 84th scattered from a trench ahead of them: “Then for the crew... began the rabbit-shooting of their fondest dreams. Streams and streams of the enemy, their retreat cut off by Tosh and their front menaced by the approaching wave, broke wildly from cover. As fast as the gunners could reload, they poured in a hail of bullets, Tosh himself firing and yelling like a maniac. At last the panic subsided, the remainder of the enemy apparently realising the futility of an attempt to escape: but it left Tosh and his crew hoarse with joy and almost beside themselves with excitement. To those who have never experienced it, the lust of battle must always appear unnatural and terrible, but ever after Tosh would look back to those few minutes of slaughter as among the most joyful moments of his life.”

A YEAR OF FAILURE

Such emotions may appear strange, even disturbing in someone like Macintosh – the son of a South African MP, a loving family man and later a prominent lawyer who was described as being “of modest and gentle nature”.

In part the passion no doubt stemmed from the release of pent-up frustration after years of static trench warfare, in which the odds had been heavily weighted against the attackers and in favour of the defenders.

There was also an overwhelming sense of relief – even disbelief – that the attack was going so precisely to plan. For the Battle of Cambrai was nothing short of a last-ditch gamble to show that tanks really were viable as a weapon of war. It was, in effect, an attack in which tanks would either make history or become history.

To understand this, it is necessary to look back over the preceding 14 months since the first tentative tank action on 15 September 1916. The 25 or so primitive Mark I machines had a formidable effect on German morale and an equal but opposite effect on British morale both at home and abroad. But a series of further piecemeal operations during the Battle of the Somme and then in the battles of

‘BETRAYAL’ BY THE POWS

THE ELEMENT OF SURPRISE WAS NEARLY LOST WHEN BRITISH PLANS WERE REVEALED TO THE ENEMY

...the element of surprise was nearly lost when British plans were revealed to the enemy. The attack was planned for the night of 20 November, but the weather was so bad that it was postponed until the morning of 21 November. The attack was a complete success, and the British tanks broke through the German lines.

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PETROL TANK

CAPACITY: 318l
(70g)
CONSUMPTION:
0.2km per litre (0.5
miles per gallon)
RADIUS OF ACTION:
56km (35mi)

Illustration: Alex Pang

ENGINE

Daimler 105hp, six-cylinder, two-speed and reverse gearbox, with secondary two-speed selectors. **MAXIMUM SPEED:** 6kph (3.7mph)
Engine in same compartment as crew, who were exposed to noise, heat and fumes.

TRACKS

90 steel plates with unsprung suspension.

Some of the Royal Irish Fusiliers who were captured in a trench raid on 18 November, posing with their German captors in Cambrai

BIRTH OF A BEAST

Arras and Bullecourt in March and April 1917, revealed not so much the potential capabilities of tanks as their appalling vulnerability.

Although their armour plating was largely effective against small-arms fire, it was no protection against a direct hit from a field gun. Tanks also faced the constant risk of mechanical breakdown and above all of becoming bogged down – referred to as ‘ditched’ or ‘bellied’ – in ground that had been churned up by prolonged artillery bombardment.

This became all but inevitable from the end of July 1917, when tanks were sent to spearhead the British offensive in the Ypres Salient that became known as the Battle of Passchendaele. It was obvious to anyone that a tank, even the improved Mark IV model, would be hopelessly out of its depth in such low-lying terrain, especially once the preparatory bombardment had churned the ground into a swamp. Colonel Christopher Baker-Carr, commander of First Tank Brigade, accurately

summed up their plight: “If a careful search had been made from the English Channel to Switzerland, no more unsuitable spot could have been discovered.”

Despite this, the Tank Corps plunged dutifully but disastrously into ‘the bogs of Passchendaele’, until the entire salient seemed to be littered with the wrecked hulks of tanks, often sunk up to their sponsons in mud. It is hardly surprising that by the end of the battle the experimental weapon was widely regarded as a failure – or as rumour had it, tanks were to be abandoned as an instrument of war and the recently formed corps disbanded.

ADVANCE, HIT, RETIRE

Fortunately the unit’s commanders were men of vision and were already aware that tanks were doomed to failure unless they were allowed to fight on their own terms. Until now they

“THE TANK CORPS PLUNGED DUTIFULLY BUT DISASTROUSLY INTO ‘THE BOGS OF PASSCHENDAELE’, UNTIL THE ENTIRE SALIENT SEEMED TO BE LITTERED WITH THE WRECKED HULKS OF TANKS”



Above: Gunners from 108 Feld-Artillerie-Regiment fight a duel to the death with the tanks advancing towards them on Flesquières Ridge

had always been sent to attack over ground churned up by artillery bombardment, which in the case of the Battle of Passchendaele amounted to more than 4 million shells fired. This was deemed necessary to batter down the enemy’s defences, in particular the belts of barbed wire that posed an impassable barrier to the infantry.

The Tank Corps top brass were well aware that they could only succeed if they attacked over firm, unbroken terrain that had not been



pulverised by artillery fire, with the tanks themselves crushing paths through the wire to be followed by the infantry and cavalry. Under this new doctrine of warfare, the role of the artillery was also transformed, as described in the official history of the battle: "If complete surprise were to be secured, the artillery must be assembled in secret and deliver a sudden storm of fire at zero hour without any previous ranging or registration." Advances in surveying, calibration and ranging made this possible in theory, but it had never been attempted on a large scale.

Putting these ideas to the test would require a bold experiment, and the chosen setting was a section of the line fronting the key German stronghold of Cambrai. The sector was bounded to the left and right by two canals, which would trap the defenders in a killing zone if the frontline could be breached. On the face of it this seemed unlikely, since the Germans had constructed a formidable defensive system in the rear of the fighting and then pulled back to occupy it in the spring of 1917. However, the positions were known to be relatively lightly manned, since the Germans reasoned that no attack could take place without a lengthy bombardment, giving them

ample time to bring up reserves. The area was therefore vulnerable to a surprise assault, and the well-drained downland was perfect country for tanks.

According to the leading strategist Lieutenant Colonel John Fuller, the attack was originally conceived as no more than "a surprise raid, the duration of which would be about 24 hours. The whole operation may be summed up in three words: 'Advance, Hit, Retire.'"

But this idea became conflated with a wider Third Army plan to storm the Hindenburg Line, with cavalry pouring through the breaches to threaten Cambrai itself. The British commander

H45 Hyacinth, ditched near the village of Ribécourt on November 20, dramatically illustrates the hazards of crossing the wide German trenches



BIRTH OF A BEAST

Sir Douglas Haig gave his blessing to the project, recognising that it would help to maintain pressure on the Germans after the Third Battle of Ypres had drawn to a close. However, he added one caveat: the entire sector was dominated by the Broulton Ridge with its sinister crest of woodland, and this high ground had to be taken on the first day, otherwise the British gains would be unsustainable and the advance halted.

So the tanks were to be given the chance to prove themselves, but in the context of an offensive whose scope and objectives were loosely defined. As it turned out, their very success contained the seeds of failure.

IN SIGHT OF VICTORY

Unlike previous attacks in which the various arms had little contact beforehand, Cambrai was envisaged as the first truly combined operation with individual infantry units and tank crews training and even socialising together to ensure complete understanding and co-operation. As we have seen, the success of this planning was apparent in the first phase of the attack, with some participants likening it to an exercise or parade ground manoeuvre.

So on 20 November 1917 the irresistible force of tanks and infantry swept almost all before it, punching an enormous hole through the German defences along a 9.6-kilometre (six-mile) front. In a war when advances were often measured in hundreds of yards and tens of thousands of casualties, the enemy were driven back five to 6.5 kilometres (three to four miles) at a cost of around 4,000 British dead, wounded and missing. The attackers inflicted severe losses, taking more than 4,000 prisoners and destroying or capturing 100 field guns. Incredible though it seems, in one day they had seized an area roughly equal to the entire gains in the Third Battle of Ypres.

However, victory was not total. Around Flesquières, in the north of the battle zone, German field guns hidden in the dead ground exacted a fearful toll on the advancing tanks, firing over open sights to destroy at least 28 machines as they breasted the ridge. This enabled the infantry to mount a desperate defence of the village, holding the elite troops of 51st (Highland) Division at bay until the Germans withdrew during the night to avoid being surrounded. The consequences of this delay were serious, for the cavalry was unable to advance across the ridge on their crucial mission to seize the Broulton Ridge. Similarly, the strategically important crossings over the St Quentin Canal at Masnières on the right of the advance were blocked or destroyed, limiting the opportunity for an encircling cavalry thrust to the east.

With Broulton still in enemy hands, the offensive had failed to meet Haig's main criterion for success, but the spires of Cambrai were in sight and it seemed inconceivable to simply abandon such spectacular gains. The offensive continued, but its character had completely changed. The glorious élan of the first day was gone, to be replaced by the kind of gruelling slog that we normally associate with the Great War. The Tank Corps had already paid a heavy price for its heroism, with 179 of its 378 fighting tanks put out of action on 20



A tank rolls through a shattered village on its way to the frontlines



November from a combination of breakdowns, ditching and direct hits. The survivors continued to play their part, but there were no fresh reserves to call on and no more opportunities for the carefully co-ordinated surprise attacks that proved so devastating at the outset.

After days of bitter fighting on Bourlon Ridge and in the surrounding villages, the Third Army commander General Sir Julian Byng finally ordered a halt to the offensive on 27 November. The crest of the hill had been captured, but the enemy still controlled the shoulders of the ridge, and there were insufficient resources to dislodge them. The British settled down to consolidate their gains, but it was a dispiriting end to a campaign that had started so brilliantly. In the words of the official historian, "None could view with satisfaction the events of the past seven days: so many attacks had failed, so many casualties had been suffered and so much hardship endured by the troops, in attempting to force a definite issue and to break a resistance of which the strength appeared to have been consistently underestimated."

A TERRIBLE SHOCK

Having fought to a standstill, the Tank Corps now began withdrawing to its winter quarters on the Somme. On 30 November Major William Watson was preparing his tanks for departure when he noticed "strange things" were happening. "We could hear distinctly bursts of machine-gun fire, although the line should have been six miles away at least. German field gun shells – we could not be mistaken – were falling on the crest of a hill not three-quarters



Above: As the Germans cleared away wrecked tanks after the battle the fate of their crewmen was recorded in often graphic detail

of a mile from the camp... We had not fully realised what was happening, when a number of wounded infantrymen came straggling past. They told me that the enemy was attacking everywhere, that he had broken through near Gouzeaucourt, capturing many guns, and was, to the best of their belief, still advancing."

The Germans had rallied their forces, secretly brought up reserves and launched a massive counterattack, which caught the British as unawares as the original advance had caught them ten days before. Their assault took the form of a great pincer movement designed to drive the British out of the ground they had taken. It was eventually halted through determined resistance on both axes of the advance, though not before the Germans had made substantial gains to the south, equivalent to the area captured by the British and resulting in a similar number of prisoners. Both sides could therefore declare the honours more or less even when the German advance itself ground to a halt.

The British position in Bourlon Wood now formed an untenable salient, and on the night of 4–5 December they pulled back to a new 'line of resistance', mainly following the old Hindenburg support system along Flesquières Ridge. With that, everyone settled down for the winter.

Both sides could draw some reassurance from the outcome of the battle. The Germans had demonstrated the effectiveness of their newly refined infantry and artillery tactics, involving the use of dedicated stormtroopers, which were to prove nearly decisive when put into full-scale operation in March 1918.

On the other hand, although flawed in its overall conception, the Battle of Cambrai has gone down in history as the first, crucial demonstration of the power of tanks when used effectively en masse and in combination with other arms. From now on no defensive position could be considered impregnable, especially once the more manoeuvrable Mark V tanks became available in early 1918.

The Bavarian Crown Prince Rupprecht, commander of the army group at Cambrai, recognised that conditions had fundamentally changed. "The enemy will be able to repeat such hit-and-run attacks wherever the terrain permits the use of tanks. So we can no longer talk about 'quiet fronts.'" Ironically, they had been driven back by a combination of guile, careful planning and mechanical ingenuity – characteristics we normally associate with the German rather than the British army.

Leutnant Bernhard Hegemann of 84 Infanterie-Regiment, who was captured in the battle, had a final word: "Here our high command suffered a terrible shock, just like the one experienced by the Romans when Hannibal and his elephants appeared in Italy after going through Spain and Gaul and across the Alps. What the elephants of Carthage were to the legions of Rome, so to a devastating degree were the English tank squadrons to the German troops – a tour de force of British military engineering."

"FROM NOW ON NO DEFENSIVE POSITION COULD BE CONSIDERED IMPREGNABLE, ESPECIALLY ONCE THE MORE MANOEUVRABLE MARK V TANKS BECAME AVAILABLE IN EARLY 1918"



After the war, wrecked tanks from 5 Battalion still littered the ridge of Flesquières beside the German trenches that had been their objective

A7V TANK

One of the earliest tanks to be produced, the A7V was supposed to deliver German soldiers a mobile fortress to break through Allied lines, but it wasn't a great success

Designed specifically to counter the emergence of British tanks on the Western Front during WWI, the A7V was a medium-armoured tank created by the German General War Department in 1916. The vehicle resembled a mobile pillbox or armoured personnel carrier and delivered a steel-plated body with the capacity to hold 18 soldiers, a 57mm cannon and six to eight 7.9mm machine guns. Its role, as hinted at by its German classification, Sturmpanzer-Kraftwagen, (which translates roughly as 'assault armoured motor vehicle') was to assault and break through fortified Allied lines as armies became increasingly entrenched.

The first pre-production A7V was delivered in September 1917 and was closely followed by the first production model in October of the same year. Despite this, the first deployment of the A7V had to wait until March 1918, when five of the 20 made were deployed north of the Saint Quentin Canal in northern France. Unfortunately, this is where the first design flaws of the vehicle were initially discovered.

Three of the five tanks broke down during operation due to mechanical faults. Despite these issues, the A7V fleet was

then deployed en masse, with 18 vehicles participating in the Second Battle of Villers-Bretonneux in April 1918.

Although reports from Allied soldiers at the time state that the A7V's armour made direct attack from their handheld weapons impossible, the A7V's modest protection was easily breached by the Allied Mark IV's six-pounder cannons. Furthermore, due to the low clearance and crude design of the A7V's suspension and tracks, many got stuck on difficult off-road terrain and two even toppled into holes. In addition, after a swift counterattack by Allied forces, three of the stranded A7Vs were captured.

As such, even though 100 A7Vs had originally been ordered, their limited impact led to the programme being scrapped, with many of the remaining vehicles dismantled as early as October 1918, shortly before the end of the war in November.

Today, no original A7V has survived, with the majority of them destroyed. However, a replica based on original designs was built between 1987–1990 and can now be viewed at the Panzermuseum in Munster, Germany, a lasting testament to an unusual machine.

ANATOMY OF AN A7V

WE BREAK DOWN THIS ICONIC TANK TO SEE HOW IT WAS BUILT AND HOW IT WAS OPERATED IN THE FIELD

ARMOUR

Despite having 20mm steel plate at the sides, 30mm at the front and 10mm on the roof, the A7V was easily penetrated by cannon fire. This was because the steel was not hardened armour plate. As such, it could only stop small-arms fire.



ARMAMENT

The main weapon of the A7V was a 57mm Maxim-Nordenfelt cannon, which was equipped to all male variants. The secondary armament was a series of six to eight 7.9mm MG08 machine guns. The tank could also carry 180 shells for the cannon.



A replica of an A7V based on original schematics is viewable today at the Panzermuseum in Munster, Germany

CREW

An A7V's crew consisted of 17 soldiers and one officer. These were needed for the following roles: commander, driver, mechanic, two artillery men (gunner and loader) and 12 infantry men (six gunners and six loaders).

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A shot of an A7V and its crew from July 1918



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“MANY GOT STUCK ON DIFFICULT OFF-ROAD TERRAIN AND TWO EVEN TOPPLED INTO HOLES”

A7V

COMMISSIONED: 1916
WEIGHT: 30 TONS
RANGE: 467KM (290MI)
CREW: 18
ENGINE: 2 X DAIMLER FOUR-CYLINDER PETROL (200HP)
ARMOUR: SIDES: 20MM; FRONT: 30MM ; ROOF: 10MM
PRIMARY WEAPON: 57MM MAXIM-NORDENFELT CANNON
SECONDARY WEAPON: 6 X 7.9MM MG08 GUNS

ENGINE

The A7V's power came courtesy of two centrally mounted Daimler four-cylinder petrol engines, each capable of generating 100hp. The engines were fed by a 500l (132ga) fuel tank. At full power, the A7V could travel at a maximum speed of 15kph (9mph).

SUSPENSION

The A7V was equipped with helical springs, rear-drive sprockets, front-mounted idlers and 24 roller wheels in bogies. The lack of shock absorbers made the ride incredibly bumpy and the low clearance (190–400mm) led to poor off-road capabilities.

An A7V on the Western Front in March 1918



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TITANS OF WAR



HITLER'S WAR ON THE WORLD WOULD LEAD TO THE CREATION OF SEVERAL ICONIC TANKS, FROM THE AMERICAN SHERMAN TO THE THIRD REICH'S TIGER I AND THE SOVIET-BUILT T-34

Inset: Troops of the U.S. Ninth Army steer their Shermans through a field in Germany, November 1944



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How clever adaptations helped the Allies

Operator's Handbook

MATILDA II

Developed in the mid-1930s, this infantry tank was conceived to provide direct fire support for troops on the ground, emphasising armour protection

WORDS MIKE E. HASKEW

TWO-POUNDER GUN

The QF two-pounder gun was developed by the Royal Arms Arsenal at Woolwich as a turret-mounted main weapon for tanks and a towed anti-tank weapon.

CREW COMPARTMENT

The Matilda II driver sat forward and centred in the tank crew compartment. The gear selector was installed to his right and the steering lever at his left.

When the Matilda II Infantry Tank, initially known as the A12 Infantry Tank Mk. II, reached the frontlines of the British Army in 1940, its armour protection and two-pounder (40mm) main gun made it a formidable weapon capable of defeating much of the German and Italian armour in the field at the time. Although it shares a common name with its predecessor, the Matilda I, the similarity generally ends there. The Matilda I was intended as an interim design until the Matilda II became available in substantial numbers. The Matilda II was developed with infantry support in mind – speed was a secondary consideration while firepower and armour protection took precedent.

As the Matilda II was deployed to France, it proved impervious to early German anti-tank weapons and vulnerable primarily to heavy-calibre field artillery. Its rugged durability made it a favourite among tank crews, and the Matilda (the designation Matilda II was dropped when the smaller Matilda I was withdrawn from service in 1940) gained fame in the North African theatre during WWII, earning the nickname 'Queen of the desert'. Soon, however, the pre-eminence of the Matilda was eclipsed by heavier German tanks, although it remained in service for the duration of the conflict.

ENGINES

A pair of six-cylinder, 71 (1.85g) water-cooled AEC engines, the same powerplants that drove London city buses, powered the Matilda II tank. An alternative to the AEC diesel engines powering the Matilda II were a pair of Leyland six-cylinder petrol engines that generated slightly more horsepower.

TURRET

The Matilda II turret was hydraulically powered, and three crewmen, including the commander, gunner and loader, were positioned in the rather cramped space.

“THE MATILDA II WAS DEVELOPED WITH INFANTRY SUPPORT IN MIND – SPEED WAS A SECONDARY CONSIDERATION WHILE FIREPOWER AND ARMOUR PROTECTION TOOK PRECEDENT”

ARMoured SKIRTS

Heavy armour side skirts and mud chutes protected the wheels and tracks of the Matilda II and improved mobility in difficult terrain and weather conditions.

MATILDA II

COMMISSIONED: 1939

WEIGHT: 51 TONS

RANGE: 257KM (160MI)

CREW: 4

ENGINE: 2X LEYLAND 6-CYLINDER PETROL ENGINES OR 2X 6-CYLINDER AEC DIESEL ENGINES

ARMOUR: 20-78MM

PRIMARY WEAPON: 1X ORDNANCE QF TWO-POUNDER (40MM) GUN

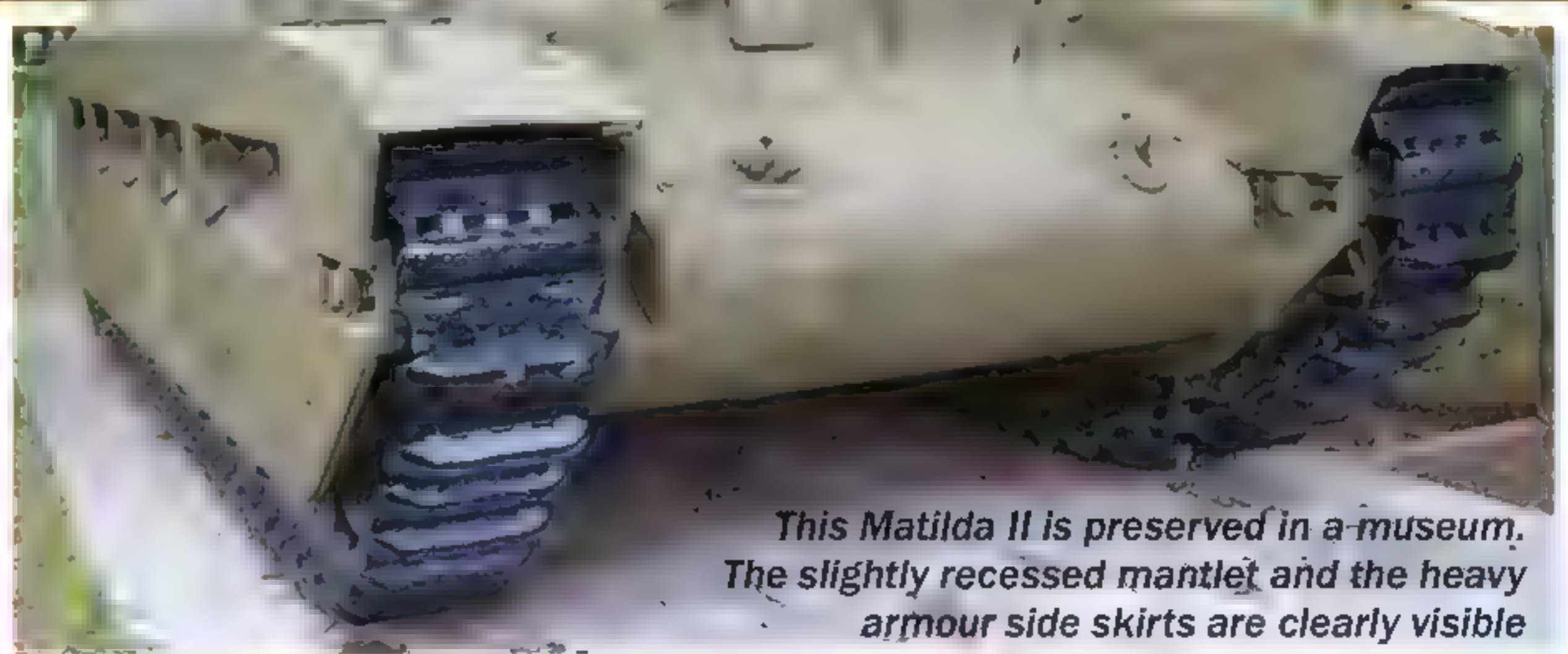
SECONDARY WEAPON: 1X 7.92MM BESA MACHINE GUN

Men and women on the factory floor move a gun mantlet and its encased weapon into place in the turret of a Matilda II

“ORIGINALLY DEVELOPED BY VICKERS AND THE DESIGN DEPARTMENT OF THE ROYAL ARMS ARSENAL AT WOOLWICH, THE TWO-POUNDER ENTERED PRODUCTION IN 1936, AND MORE THAN 12,000 WERE PRODUCED BY 1944”

ARMAMENT

The primary weapon of the Matilda II was the Ordnance QF two-pounder (40mm) gun, developed both as a tank-mounted main weapon and a carriage-mounted anti-tank gun. Originally developed by Vickers and the design department of the Royal Arms Arsenal at Woolwich, the



This Matilda II is preserved in a museum. The slightly recessed mantlet and the heavy armour side skirts are clearly visible



DESIGN

With its design beginning in 1936 at the Royal Arsenal, Woolwich, and manufactured by Vulcan Foundry, the Matilda II was a large infantry-support tank based on the conceptions of armoured warfare pioneers Major General Percy Hobart and Captain B.H. Liddell Hart. Weighing 51 tons, the Matilda II incorporated elements of the earlier A7 medium tank. Its heavy armour protection ranged up to 75mm on the turret glacis, and its 360-degree revolving turret was hydraulically powered. Its tracks were covered with heavy armour skirts, including mud chutes for mobility.



Preparing the Matilda II for transport on flatbed rail in Britain and then to the frontlines



This romanticised view of the Matilda II in action does convey one important aspect of its service – the tank was a game-changer when it appeared in combat in North Africa

ENGINE

The Matilda II was powered either by a pair of straight six-cylinder, water-cooled, seven-litre (1.85-gallon) AEC diesel engines – the same that powered London buses – and generating 87 British horsepower, or two Leyland six-cylinder petrol engines generating 95 British horsepower. The tank was slow, capable of a top road speed of only 26 kilometres (16 miles) per hour and a mere 14 kilometres (nine miles) per hour cross-country, and its lack of an adequate powerplant limited operations. A six-speed Wilson epicyclic preselector gearbox served as the transmission.



The Matilda II was powered by a pair of engines, although its lack of power limited its effectiveness as the war progressed



The Matilda II was capable of a top road speed of only 26kph (16mph)

COCKPIT

The interior of the Matilda II featured two driver seats, located forward and angled in the same direction. The steering wheel was located in the left hand and the gear controls in the right. The turret commander's position was centrally located and provided a good view of the front. The turret commander's position was centrally located and provided a good view of the front. The turret commander's position was centrally located and provided a good view of the front.

Early on in the war the Matilda's armour protection made the vehicle highly survivable for crews

"EARLY ON IN THE WAR THE MATILDA'S ARMOUR PROTECTION MADE THE VEHICLE HIGHLY SURVIVABLE FOR CREWS"



With a commander's pennant flying, a Matilda II tank advances in the North African desert



SERVICE HISTORY

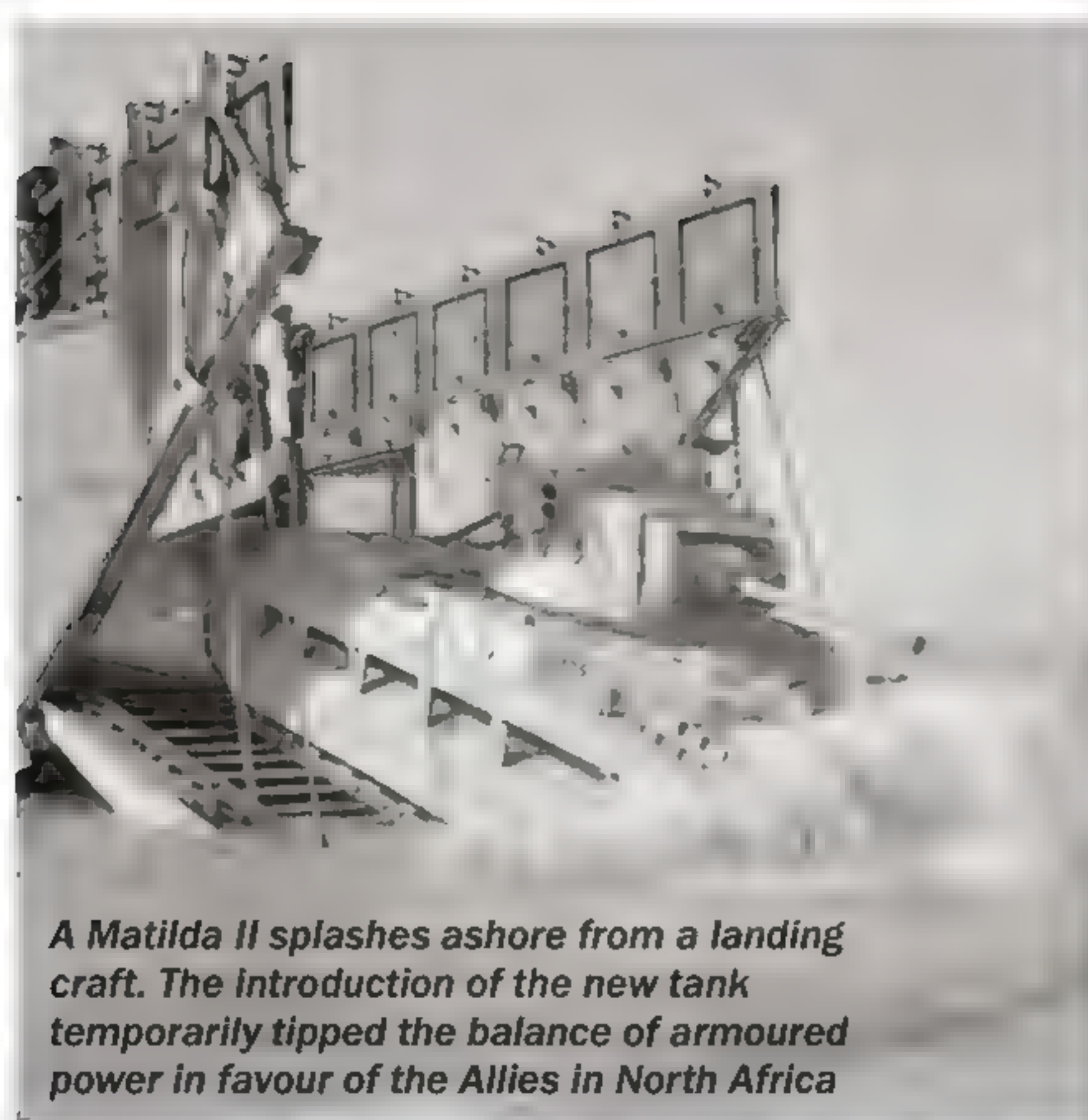
A POWERFUL TANK EARLY IN THE WAR, IT WAS LATER OUTCLASSSED BY AXIS ARMOUR AND GUNS

In May 1940, a contingent of 50 Matilda II tanks were deployed to France, although scarcely half were available for combat at any given time. The excellent range of the Matilda's two-pounder gun achieved stunning results at the Battle of Arras on 21 May, as 16 Matildas inflicted heavy losses on the German 7th Panzer Division under General Erwin Rommel. The Matilda tide was only turned when the Germans employed 88mm anti-aircraft guns in an anti-tank role.

The Matilda is particularly remembered for its service early in the North African Campaign during WWII. Outclassing Axis tanks, particularly inferior Italian vehicles, the Matilda earned the nickname 'Queen of the desert'.

Matilda crews destroyed half the armoured complement of the German 15th Panzer Division at the Battle of Point 175 during Operation Crusader in 1941. However, dozens were lost to improved German anti-tank guns and armoured vehicles during Operation Battleaxe.

A Matilda II splashes ashore from a landing craft. The introduction of the new tank temporarily tipped the balance of armoured power in favour of the Allies in North Africa



"MATILDA CREWS DESTROYED HALF THE ARMoured COMPLEMENT OF THE GERMAN 15TH PANZER DIVISION AT THE BATTLE OF POINT 175 DURING OPERATION CRUSADER IN 1941"

German soldiers pick over a Matilda in France, 1940



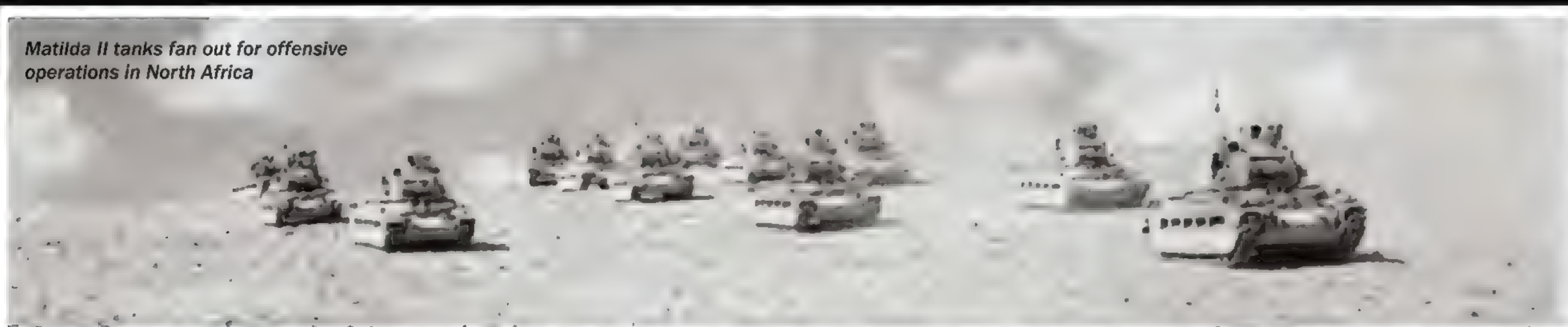
British crewmen maintain a wary lookout for enemy activity



After a fierce encounter with elements of the Axis Panzerarmee Afrika, a Matilda II lies abandoned on the battlefield



Matilda II tanks fan out for offensive operations in North Africa



AN END TO THE BEGINNING

**THE SECOND BATTLE OF EL ALAMEIN
(23 OCTOBER – 11 NOVEMBER 1942)**

Eighty-one years ago, the Allied 8th Army launched a decisive offensive against the Axis forces in North Africa. It saw the tipping point of a long struggle for dominance over the region and precipitated the Axis collapse in the Mediterranean

WORDS JOHN SADLER



An Allied soldier salutes two captured Axis men after victory in the North African theatre.

Hitler did not want to fight for North Africa in 1941. His gaze had long been fixed on the steppes of the East. Egypt was the prize his ally Benito Mussolini coveted. Yet Il Duce's ill-judged invasion of Greece was compounded by failure in Libya when generals Wavell and O'Connor's strike in December 1940 (Operation Compass) heralded disaster for Italy. Erwin Rommel was grudgingly sent in with meagre forces and tasked with stemming the rot. But this tortoise turned into a hare. The Desert Fox – generally at odds with his hosts and nominal superiors, not to mention High Command – was a maverick genius who began to rapidly turn the tide, and keep it turning. The pendulum of war in the Western Desert began to swing, and it swung back and forth through abortive British offensives (Brevity and Battleaxe) then more tellingly with Claude Auchinleck's Crusader offensive.

Rommel wasn't daunted. He struck back, harrying the Allies eastwards, past Gazala and Mersa Matruh, into Egypt and the El Alamein Line. Auchinleck saw him off in the First Battle of El Alamein (1–27 July 1942) but failed to mount a successful counterstroke. By now Churchill, desperate for a convincing victory, had tired of 'The Auk' and his mercurial Chief of Staff, Eric Dorman-Smith. He appointed General Harold Alexander to overall command and gave 8th Army firstly to William Gott, whose death in a plane crash then cleared the path for Bernard Montgomery.

Alexander's instructions were plain, as set out in a directive on 10 August.

"Your prime and main duty will be to take or destroy at the earliest opportunity the German-Italian Army commanded by Field-Marshal Rommel together with all its supplies and establishments in Egypt and Libya.

"You will discharge or cause to be discharged such other duties as pertain to your Command without prejudice to the task described in paragraph 1 which must be considered paramount in His Majesty's interest."

Monty was the new broom, as described in the *Official History (Volume 3)*: "General Montgomery... set to work at once to inspire confidence and enthusiasm in his Army. His address to the officers of Army headquarters made a tremendous impact, of which word soon spread. The defence of Egypt lay at El Alamein, he said, and if the 8th

Army could not stay there alive it would stay there dead. There would be no more backward looks."

He first fought Rommel to a standstill at Alam Halfa (30 August – 5 September 1942) but made no immediate moves to riposte. Caution prevailed, and his offensive, when it came, would be based on significant superiority in men and materiel. Rommel was being starved of resources partly by Hitler (Operation Barbarossa was beginning to stutter) and partly by Ultra, as Enigma intelligence enabled the Royal Navy to target Italian supply convoys. New Allied tanks (M4 Shermans) and improved six-pounder A/T guns eroded previous Axis tactical weapons superiority.

"Montgomery was what I call a bit of a bullshitter, but I think that was part of his act, and very effective, I think," observed Sergeant J. Longstaff of the 2nd Battalion Rifle Brigade. "He had to publicise himself and build up a reputation against Rommel, whose reputation was extremely high. We all thought the world of Rommel. If you were opposite Rommel, you expected something to happen. He did have a very demoralising effect on British troops. He was a bloody good general." Monty had much to prove.

Out of the chaos of earlier retreats, the forced abandonment and destruction of materiel, order was re-emerging. With communication lines short and a great quantity of supplies flooding into Suez, losses were being made good. It was barely 100 kilometres (62 miles) from Alamein to the main depot at El Amiriya and links between there and Suez were still functioning. Wavell's realisation that Egypt could be developed into a vast workhorse had, by 1942, become a tangible reality. The Nile Delta was a thriving war-based economy. Food was grown and reared, combining with a sophisticated industrial expansion aimed at maximum war production. These vital functions, undertaken respectively by the Royal Army Service Corps (RASC) and Royal Army Ordnance Corps (RAOC), provided Monty with the sinews of a war machine in the desert.

As the autumn drew on the moment of decision grew nearer. This battle would be akin to a Great War 'break-in' offensive, with the Allies chewing their way through deep Axis defences and sucking their reserves into a cauldron where sheer numbers would decide the outcome. But mere might, however crushing, can always use a helping hand.

**"THIS IS NOT THE END. IT IS NOT EVEN THE BEGINNING OF THE END.
BUT IT IS, PERHAPS, THE END OF THE BEGINNING"**

WINSTON CHURCHILL



Bayonets fixed, Allied soldiers attack an Axis position during the decisive battle



DECEPTION – OPERATION BERTRAM

As Montgomery described in his *Montgomery of Alamein* memoir, the object of the deception plan was twofold:

- “1) To conceal from the enemy as long as possible our intention to take the offensive.
- 2) When this could no longer be concealed, to mislead him about both the date and the sector in which our main thrust was to be made.”

Deceit in war is as old as conflict itself, from the Trojan Horse to Operation Fortitude, which sought to confuse the Axis as to Allied intentions during the build-up to D-Day in the spring of 1944. In the case of Operation Lightfoot, as the break-in phase of the planned battle was called, deception was a significant part of overall preparation. In the north, 30 Corps sector, where the main attack was planned, a great mass of dummy vehicles, tanks and guns had been fabricated to create an impression of density. Immediately prior to the attack, under cover of darkness, these were replaced by the real thing as the dummies were transported to the rear. In this way, the static fiction was maintained. At the same time, Lieutenant Colonel Charles Richardson, the 8th Army wizard masterminding the whole show, had to conceal vast supply dumps that were being created. That they were satisfactorily kept hidden was a masterpiece of disguise brought into being by Lieutenant Colonel Geoffrey Barkas, director of Camouflage at GHQ Middle East.

Dumps, such as that at Imaid, covered very large areas, in this case some eight square kilometres (three square miles). Dummy vehicles were again employed to conceal the crates of ammunition within the timber and canvas frames, and fuel cans were hidden in existing yet ostensibly

Above left: Troops of the 8th Army manning an artillery piece come under fire from enemy shells

Above right: One veteran recalled how they advanced accompanied by the “sort of orchestral music of the continuous guns in the background”

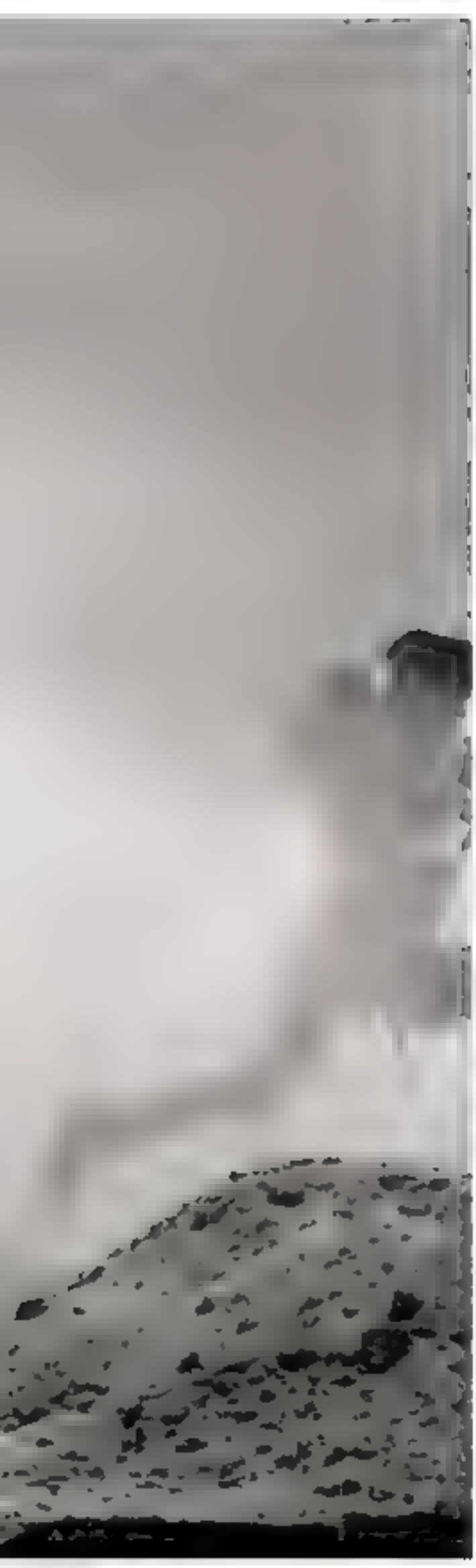
abandoned trench lines. The distinctive 25-pounders, with their equally recognisable quad tractors to be concealed in the forward areas, were artfully disguised by fixing a false section to the tractor to make it resemble an ordinary truck and by bunching gun and limber then placing a fake screen over the top.

“We were engaged in ‘creating’ a concourse of tanks and lorries and even an HQ to confuse the enemy reconnaissance planes,” recalled one soldier in *Alamein: Recollections of the Heroes*. “It was all done by hessian, some string and some very light wood, poles etc. The dummy camp and vehicle sites were erected at night with the help of moonlight and during daylight gave the appearance of busy military areas to very high-flying enemy planes. Vehicles travelled around and about creating clouds of dust and in early morning every encouragement to brewing up amongst the dummy bivouac was given, and of course, round the vehicles, or tanks, outlined in hessian, supported by thin wooden poles or ‘cats’ cradles of strong twine.”

To provide an impression that the main effort was to be directed toward the southern sector, part of the deception involved building 30 kilometres (18.6 miles) of dummy ‘Diamond’ water pipeline. “The pipe-trench was excavated in the normal way,” explained Montgomery in *Montgomery of Alamein*. “Five miles [8km] of dummy railway track, made from petrol cans, were used for piping. The ‘piping’ was strung out along the open trench. When each five-mile

Below: To deceive the Germans’ observation planes, timber and canvas frames were used to disguise Allied artillery and tanks as trucks





Above left: Field Marshal Erwin Rommel (left) and General Ramcke pictured before the Second Battle of El Alamein

Above right: Operation Lightfoot saw Allied tanks pour through gaps in the Axis defences created by the infantry

section of the trench was filled in, the 'piping' was collected and laid out alongside the next section. Dummy pump houses were erected at three points; water points and overhead storage reservoirs were made at two of these points."

He deemed Bertram a success, but this is hard to evaluate. Nonetheless, Axis intelligence remained convinced the main blow would fall in the south. One vital area, wherein 8th Army's performance improved exponentially, was that of signals and wireless communication. Ultra intercepts betrayed every Axis move and Rommel's ears had been clipped with the elimination of his elite interceptors. 'Ghost' radio traffic was added to the sprawling web of deception to mask troop movements.

"We were told that the last battle of the Alamein line – of Rommel's attack – would take place right in the sector that we were in front of – at Alam Hafa," said Longstaff. "We had something unique. We had magicians in charge of our camouflage. Large tins that had held potatoes were made to look as if they were anti-tank guns, vehicles were made with

hessian to look like tanks – tanks were made to look like vehicles. Petrol supplies were made out of any old rubbish. Water points were made where there were no water points."

OPERATION BRAGANZA

On the night of 29 September Lieutenant General Brian Horrocks, commanding 13 Corps to the south, launched a preliminary mini offensive. His objective was to seize ground by Deir el Munassib, which would facilitate wider deployment of Allied guns prior to the main push. One infantry brigade, 131st (Queens), together with elements from 4th Armoured supported by nine field artillery regiments and one medium battery, made up the contingent. Battle commenced at 5.25 a.m. when 1/6 Battalion, Queen's Royal Regiment (West Surrey) struck the northern shoulder with 1/7 battalion hitting the east. Opposition was relatively weak but 1/5 Battalion ran into tough Italian paras from 185th 'Folgore' Division when they attacked south. Overall, gains were meagre.

Horrocks tried a second push to capitalise on these limited successes, especially in the north, where 132nd (Kent) Brigade made further gains. Ironically, more casualties resulted from heatstroke rather than wounds. In the south the British still managed little headway and Horrocks called off the attack.

OPERATION LIGHTFOOT

Lieutenant-General Oliver Leese, with 30 Corps, would be responsible for leading the main effort in the north, where infantry would punch two corridors through Axis defences along which General Herbert Lumsden could send 10 Corps armour. The intention was that Allied tanks would pour through the gaps and draw Rommel's panzers into a melee.

"WE HAD MAGICIANS IN CHARGE OF OUR CAMOUFLAGE. LARGE TINS... WERE MADE TO LOOK AS IF THEY WERE ANTI-TANK GUNS"



A German 'Kettenkrad', a light half-track vehicle, pictured in North Africa, 1942



German prisoners from the Afrika Korps wait by a signpost to El Alamein, October 1942



Below: One Allied soldier recalled, "I can still remember the shriek from one of my platoon when a booby trap... literally blew him to pieces"



Horrocks, in the southern sector with 13 Corps, would attack the enemy positions and operate with 7th Armoured Division to draw German armour in that direction. The aim was to make it easier for 10 Corps to break into the open to the north. The Desert Rats were not to get drawn into attritional 'dogfights'; they were to husband their strength for pursuit once the breakout was achieved. Monty allowed himself full credit for the idea of delivering the main blow in the north and avoiding the tried tactic of a flanking attack from the south: "I planned to attack neither on my left flank nor on my right flank, but somewhere right of centre; having broken in, I could then direct my forces to the right or to the left as seemed most profitable."

Leese was to put four divisions into the attack. Nearest the coast the 9th Australian would have the extreme right, breaking in eastwards from Tel el Eisa. Next, the 51st Highland Division was charged with assaulting towards Kidney Ridge. Then the 2nd New Zealand Division would strike towards the western extremity of Miteiriya Ridge, with the 1st South African Division attacking the centre. The front stretched for seven kilometres (four miles) with a depth on the right of eight kilometres (five miles) shrinking to four kilometres (2.5 miles) on the left. Horrocks was to launch his offensive, diversions aside, on a narrower front with the 7th Armoured and 44th Division striking out south of Ruweisat Ridge.

In the main this was to convince the Axis forces that the heaviest blow was indeed falling in the south and to fix 21st Panzer's full attention there. Secondary objectives included attacks on Himeimat and Taqa Plateau, but these were not to be pressed home in the face of strong opposition. An intense artillery barrage, the most potent ever seen since 1918, would begin the fight at 21.40 p.m. on 23 October. The guns would deluge German artillery with

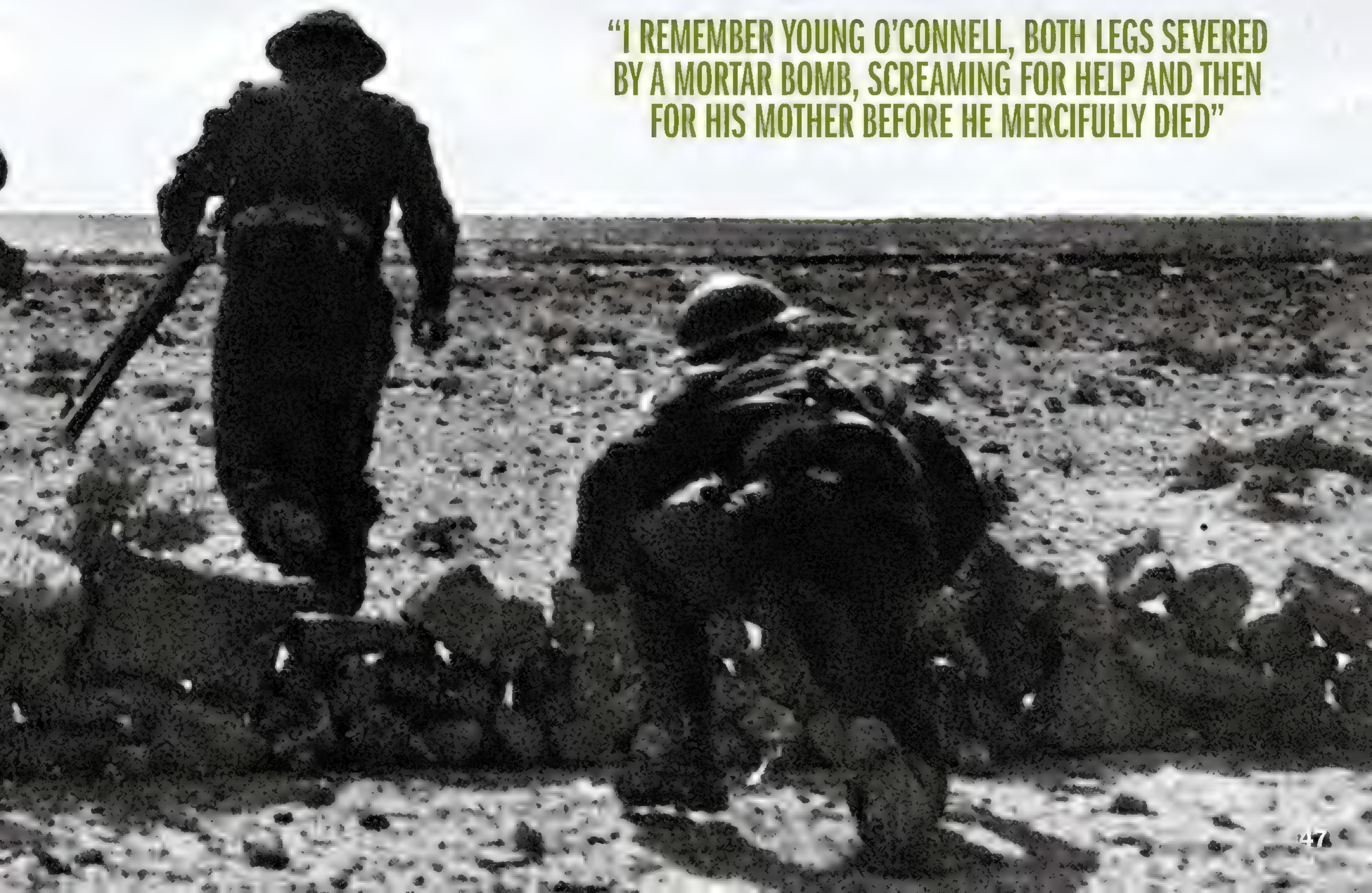
a weight of counter-battery fire before moving to plaster the forward defences. A rolling barrage would cosset the attacking infantry battalions, proceeding in 'lifts'. With a sufficiency of anti-tank guns in theatre, the whole weight of field artillery could be brought to bear under a centralised fire plan.

As ever, the troops saw things in a rather more immediate and personal light: "We set off. Excited, breathless. And that sort of orchestral music of the continuous guns in the background," recalled one soldier. "We wondered if the Jerry saw it that way! I remember seeing a captain walking behind a Scorpion. Intent on supervising the job. This tank had a barrel fastened across its nose which revolved. Fastened by one end were chains which whirled round and thumped the ground ahead. Supposed to blow up any mines in its path. Something seemed to worry the captain and he literally screamed at the crew and someone nearby. On edge, poor devil. Some job!"

Another man recounted, "We set off late one evening, two battalions, two companies up in line abreast across a thousand yards of minefields, led by an officer on a compass bearing and Lieutenant-Colonel East using a stick as a result of a First World War wound. We were to advance behind a barrage of a thousand guns. There were casualties in the platoon on my right from one gun firing short or possibly from the enemy replying. I can still remember the shriek from one of my platoon when a booby trap on the barbed wire literally blew him to pieces..."

"Eventually our leading platoon and the 1st /6th Queens on our left arrived in the middle of the Italian positions and some 20 to 30 Italians cheerfully gave themselves up and remained for the next 24 hours, withdrawing with us at the end of that time. The remainder of the Folgore Division, however, were made of sterner stuff and proceeded to

"I REMEMBER YOUNG O'CONNELL, BOTH LEGS SEVERED BY A MORTAR BOMB, SCREAMING FOR HELP AND THEN FOR HIS MOTHER BEFORE HE MERCIFULLY DIED"



inflict heavy casualties on us, using mortars and machine guns, firing from entrenched positions. I remember young O'Connell, both legs severed by a mortar bomb, screaming for help and then for his mother before he mercifully died."

OPERATION SUPERCHARGE

After the initial sound and fury of Lightfoot, followed by a period of attritional dogfighting ("crumbling", as Monty called it) there was still no sign of a breakthrough. Rommel was stretched but not bursting. It is impossible to overstate the advantages that accrued to the Allies through control of the skies and the havoc wrought by Desert Air Force. Though armoured formations were mostly safe, movement of soft-skinned Axis vehicles during this critical 'dogfight' phase was continually interdicted by attack from the air.

Nor should the corrosive effect on morale be overlooked, as Montgomery himself observed, "The morale effect of air action is very great and out of all proportion to the material damage inflicted. In reverse direction, the sight and sound of our own air forces operating against the enemy have an equally satisfactory effect on our own troops."

The damage inflicted upon Axis shipping was steadily increasing the pressure on Rommel's jugular. On 1 November two more Italian ships, Tripolino and Ostia, laden with fuel and ammunition, were sunk. Because the Germans were trying to fly in fuel stocks from Crete, Maleme airfield, site of the Axis landings in May 1941, was also bombed.

That there was progress and that, in a battle of attrition, the Allies were winning, could not be denied. But there was no great victory that could set the church bells, so long silent, ringing out. Moreover, as 8 November, the date fixed for the Operation Torch landings approached, Churchill needed a decision in the Western Desert. Much has been said about the 'long screwdriver' applied by Whitehall to the desert campaigns, usually to detrimental effect. Tradition in the British Army is for the local commander, while he receives his general orders from his superiors, to be permitted discretion as to how he puts these into effect.

"It was fairly clear to me that there had been consternation in Whitehall when I began to draw divisions into reserve on the 27th and 28th October, when I was getting ready for the final blow," said Montgomery. "Casey had been sent up to find out what was going on: Whitehall

thought I was giving up, when in point of fact I was just about to win... I told him all about my plans and that I was certain of success; and de Guingand spoke to him very bluntly and told him to tell Whitehall not to bellyache. I never heard what signal was sent to London after the visit and was too busy to bother about it. Anyway, I was certain the CIGS [Chief of the Imperial General Staff] would know what I was up to."

He then went on to assess the tactical position at El Alamein and the manner in which he intended to deliver his next major assault: "I decided on the night of 30/31 October the 9th Australian Division would attack strongly northwards to reach the sea; this would keep the enemy looking northwards. Then on the next night, 31 October/1 November, I would blow a deep hole in the enemy front just to the north of the original corridor; this hole would be made by 2nd New Zealand Division which would be reinforced by the 9th Armoured brigade and two infantry brigades; the operation would be under the command of 30 Corps. Through the gap I would pass 10 Corps with its armoured divisions... We already had the necessary divisions in reserve, and they had been resting and refitting... What in fact I proposed to do was to deliver a hard blow with the right and follow it the next night with a knock-out blow with the left. The operation was christened SUPERCHARGE!"

This decisive phase of the battle lasted from 29 October to 4 November and effectively continued the process of attrition. Monty was unwittingly aided by Hitler, who issued an order that no foot of ground should be yielded. Wisely, Rommel ignored him. Monty switched his main drive to the north and gradually the weight of attacks fractured the Axis lines. This time the rupture was fatal.

For Rommel, the scale of this defeat was enormous. Assessments differ, but the Axis had lost something in the order of 30,000 prisoners (two-thirds Italian) and perhaps as many as 20,000 dead and wounded. Most of his Italian formations had been decimated, and such transport as could be found was reserved for German survivors. Out of nearly 250 tanks they could barely field three dozen, and though the Italians had more runners these were inferior and no match for Shermans. It was indeed not just the end of the beginning; for Nazi Germany it marked the beginning of the end.

As the Allies pressed their advantage, Rommel decided to ignore Hitler's order not to retreat



Thousands of demoralised Italian troops surrendered during the fierce battle

"WHITEHALL THOUGHT I WAS GIVING UP, WHEN IN POINT OF FACT I WAS JUST ABOUT TO WIN"

The Second Battle of El Alamein was a decisive turning point in the Western Desert campaign

MEET SOME OF THE SELFLESS SOULS WHO EARNED THE MEDAL OF HONOR

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SHERMAN



THE MAKING OF A WAR WINNER

The M4 Sherman medium tank was produced in huge numbers during WWII and became the Allies' most prominent yet controversial land weapon of the conflict

WORDS MICHAEL E. HASKEW



The M4 entered production in October 1941, just one month after the prototype had been completed

Among the iconic Allied weapons to emerge during WWII, the M4 Sherman medium tank proved itself to be one of the most decisive, but it is also without doubt one of the most controversial too.

The M4 was distinctly American, and the influence of prevailing land warfare doctrine shaped its development, along with the obligatory influences that dictate the genesis of armoured fighting vehicles to this day: firepower, mobility and armour protection. Prior to U.S. entry into the war, the American military establishment watched with great interest, and frankly some astonishment, as the German blitzkrieg slashed across Europe with incredible speed and efficiency.

In response, American armoured doctrine revolved around the use of tanks as penetration and exploitation weapons. Tank-versus-tank fighting was considered only as a secondary aspect of land warfare, and when enemy tanks were encountered they were to be dealt with by open-turreted, fast-moving tank destroyers. The tank itself was to be an infantry support weapon.

While Britain and the Empire stood alone against the Nazis and President Franklin D. Roosevelt declared the U.S. to be the great "arsenal of democracy", American factories supplied tremendous amounts of war materiel to the British armed forces via Lend Lease. Among these weapons were the early production tanks, rolling off the assembly lines

and loaded on ships for the perilous crossing of the Atlantic. The earliest of these to reach British forces in substantial numbers was the M3 Grant/Lee tank.

The M3 was a ponderous vehicle whose design was reminiscent of the tanks that had fought during WWI. With its high silhouette, the M3 was vulnerable to enemy fire, while its turret was small and capable of accommodating only a relatively light 37mm cannon. To address the need for additional firepower, the M3 was armed with a 75mm gun housed in a hull-mounted sponson.

Why the throwback design? The answer was simple and startling. While the panzer divisions of the Wehrmacht already deployed tanks with turrets that could accommodate larger-calibre 50mm and 75mm guns, and British designs could as well, there was no production-ready American tank turret that could do so. Therefore the M3 was a stopgap design that could bring comparable firepower to the battlefield against German armour while American engineers rushed to design a turret and chassis that could be mass-produced and deployed in a relatively short period of time. When British tankers took possession of their first M4s, they continued their practice of naming U.S.-built tanks for generals of the American Civil War. They christened the M4 the Sherman in honour of the Civil War Union general William Tecumseh Sherman.

"THEY CHRISTENED THE M4 THE SHERMAN IN HONOUR OF THE CIVIL WAR UNION GENERAL WILLIAM TECUMSEH SHERMAN"

M4 tanks leaving the Pullman-Standard factory in Hammond, Indiana, July 1942



Chrysler Corporation's Detroit Arsenal Tank Plant built nearly 18,000 Shermans



Images © Getty

*The crew of a Sherman
pictured during training in
England, February 1944*





The Sherman played a key role in the Allies' eventual success against the Nazis in North Africa



A Sherman, crewed by British troops, advances during the pivotal battle for Caen, June 1944



A turret-mounted machine gun was used for defence against enemy aircraft and infantry

DESIGN AND DOCTRINE

As early as April 1922 the U.S. War Department had issued a policy statement regarding armoured warfare. The primary role of the tank was, it said succinctly, "to facilitate the uninterrupted advance of the rifleman in the attack". While such doctrine held sway through the inter-war years and beyond, it was naive and impractical a generation later. By the time the WWII erupted in Europe, tank-versus-tank combat was inevitable. While American generals debated the role of the tank in modern warfare, progress in design and innovation was glacial.

By 1941, the old M2 light and medium tanks were obsolete. Further, the M3 was acknowledged as something of a throwback. Even though the additional firepower of the 75mm gun was welcomed by the British during the desert war in North Africa, a superior design was clearly necessary to combat ever-improving German variants of the PzKpfw III and PzKpfw IV models deployed as early as 1941.

On 31 August 1940, a full year after the war had begun in Europe, the U.S. Army Ordnance Board was presented with a tank design that would become famous – or infamous – the world over. The prototype T6 was chosen from among five competing designs the following spring. While the T6 was in development the M3 was being produced in significant numbers, and the sense of urgency for a production model of the new tank was palpable.

The engineers who put forward the T6 design weighed the positive and negative aspects of the future M4. Speed, firepower and armour protection – the three pillars that determined a successful blueprint – had to be balanced. While armour meant protection for the crew, it also added weight, cost and larger quantities of precious steel for manufacture. Further, the tank's speed would be reduced and manufacturing time lengthened. The momentous decisions made in the design phase dictated the battlefield performance of the resulting M4 Sherman medium tank. Armour protection would be sacrificed in favour of speed and ease of mass production. This became the source of

a controversy that has raged for more than 80 years as veterans, historians and other observers have evaluated the M4's combat performance. Still, it must be acknowledged that the M4 design was in keeping with the prevailing U.S. armoured doctrine at the time.

PUSH TOWARD PRODUCTION

The exigencies of war dictated a fast track for the M4, and only a month after the prototype was completed at Aberdeen Proving Ground in Maryland the tank entered production in October 1941. A key to rapid mass production involved the retention of as many parts and features of the preceding M3 as possible. Although the upper hull was substantially reconfigured, resulting in the classic slope of armour that makes the tank silhouette easily recognisable, the M4's external propulsion system included an existing system with a front-drive sprocket connected to the gear box, rear-adjustable track idler, three sets of bogies (each with a pair of large road wheels) and three return rollers. The track configuration was a standard from the mid-1930s, and the vertical volute suspension system was initially employed.

The M4 originally mounted the short-barrelled M2 75mm cannon, deemed adequate for infantry support, along with one .30-calibre Browning M1919A4 machine gun in the turret mantlet, another ball-mounted in the hull, and a .50-calibre M2HB turret-mounted machine gun for defence against enemy aircraft or infantry. Later variants mounted the short-barrelled 75mm M3 L/40 and high-velocity long-barrelled 76mm M1 L/55, which required a turret modification to accommodate the recoil of the heavier weapon. British innovators upgunned the M4 with the Ordnance Qf 17-pounder gun and dubbed the potent platform the 'Firefly'.

Periodic variations to the M4 powerplant, welded and cast hull production changes, and other alterations occurred during the production run from 1941–45, and the tank was produced in seven primary production models. British tweaks to the design resulted in multiple variants that they called 'Marks'. The M4 weighed approximately 30 tons, and the original nine-cylinder Continental R-975 gasoline radial aircraft engine, modified for use in the tank, produced a top speed of 48 kilometres (30 miles) per hour. The tank was serviced by a crew of five: the gunner, loader and commander in the turret, while the driver and assistant driver were positioned forward in the hull.

"ARMOUR PROTECTION WOULD BE SACRIFICED IN FAVOUR OF SPEED AND EASE OF MASS PRODUCTION"

The first production model was the M4A1, and through the course of WWII more than 49,000 M4 tanks were produced, second only to the Soviet output of the famed T-34 medium tank. Along with the British Firefly, significant variants included the M4A2 powered by a General Motors 6046 diesel engine; the M4A3E8 'Easy Eight' with 58-centimetre-wide (23-inch) tracks for stability and smoother cross-country ride, and the Duplex-Drive (DD) amphibious Sherman that was deployed for the D-Day landings. One of the most critical improvements was the introduction of wet ammunition storage, helping to minimise the possibility of catastrophic explosions; however, throughout its service life the Sherman was notorious for 'brewing up'.

By far the largest producer of the M4 Sherman was the erstwhile American automobile manufacturer Chrysler Corporation, which built nearly 18,000 during the course of the war. Chrysler executives were instrumental in the construction of the Detroit Arsenal Tank Plant on a 45-hectare (113-acre) site in Warren Township, Michigan, 27 kilometres (17 miles) from downtown Detroit, the heart of the U.S. peacetime automobile industry. No fewer than ten other companies – including the Fisher Body Division of General Motors, Lima Locomotive Works, Pressed Steel Car Company, Baldwin Locomotive Works, Pullman-Standard

and Ford Motor Company – built the M4. The Canadian-built Ram tanks were based on the Sherman configuration, and the versatile M4 hull served as a platform for a variety of armoured vehicles, from self-propelled artillery to recovery, anti-mine, flamethrower and spigot mortar models.

SHERMAN GOES TO WAR

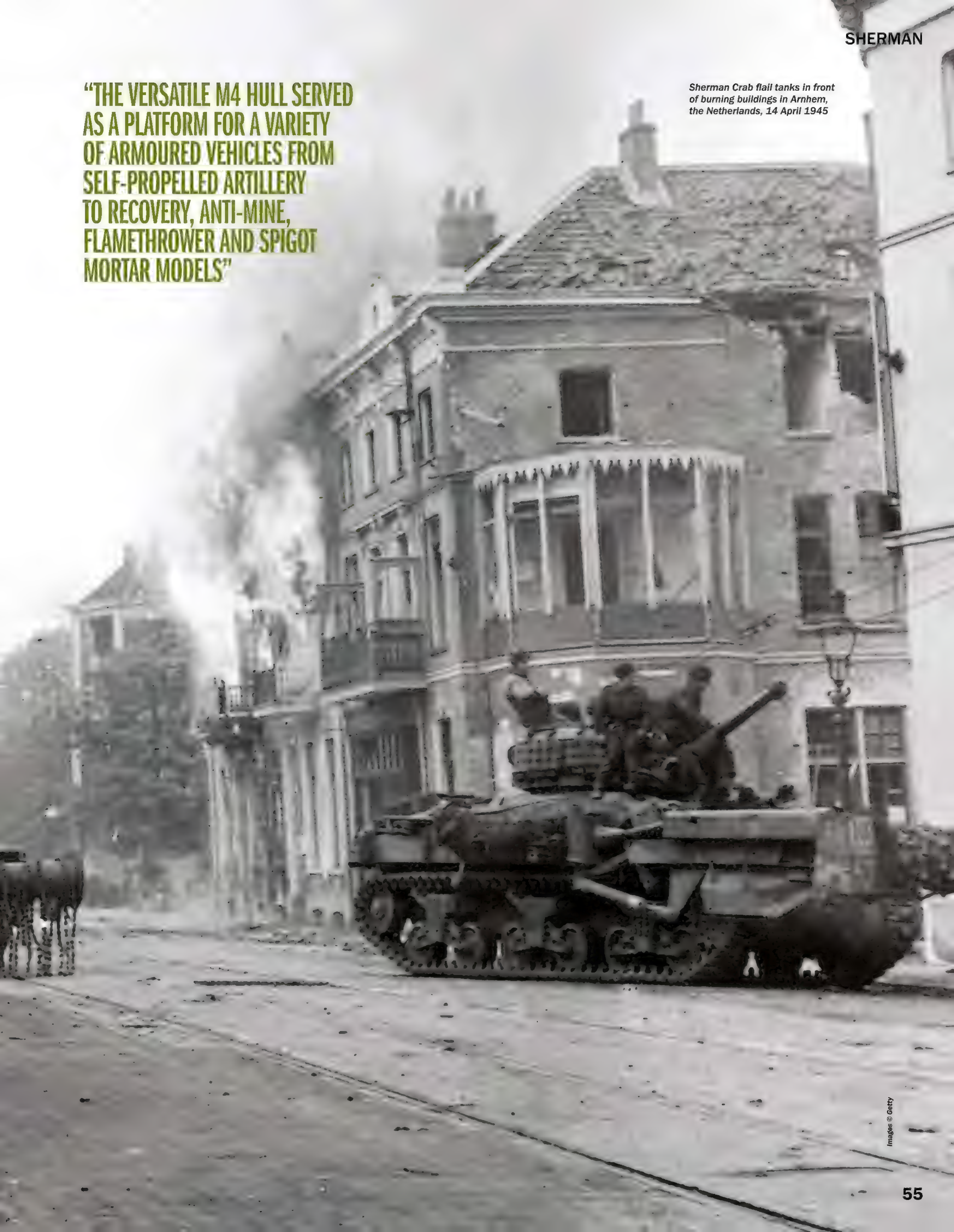
The first wartime deployment of the Sherman occurred in the wake of a desert disaster. When British Prime Minister Winston Churchill received the news that the Libyan port of Tobruk had fallen to Axis forces under General Erwin Rommel in June 1942, he was in Washington, D.C., to confer with Roosevelt. Churchill was visibly shaken, and Roosevelt offered to assist with whatever the Americans could do. The Prime Minister thought for a moment and asked for all the tanks the U.S. armed forces could spare. Meanwhile, the British Eighth Army drew a line in the desert sand at the railroad whistle-stop of El Alamein on the Egyptian frontier and easily within striking distance of the port of Alexandria, the capital of Cairo and the Suez Canal.

As Eighth Army commander General Bernard Montgomery took in supplies and reinforcements, the arrival of about 300 new M4 medium tanks was most welcome. The Shermans had been shipped aboard several freighters



"THE VERSATILE M4 HULL SERVED AS A PLATFORM FOR A VARIETY OF ARMoured VEHICLES FROM SELF-PROPELLED ARTILLERY TO RECOVERY, ANTI-MINE, FLAMETHROWER AND SPIGOT MORTAR MODELS"

Sherman Crab flail tanks in front of burning buildings in Arnhem, the Netherlands, 14 April 1945





The Sherman's relatively thin armour protection led to high casualty rates



Amphibious Duplex-Drive M4s and Allied troops battle to secure the port of Ouistreham in Normandy



A Sherman fitted with a T40 'Whizbang' multiple rocket launcher. Its 20 rockets could be fired one at a time or in salvos

in July, and by the time of the pivotal Battle of El Alamein in October 1942 more than 250 were deployed with a dozen armoured units of the Eighth Army to augment its complement of Valentine, Crusader, M3 Grant/Lee and M3 Stuart light tanks.

The 2nd Dragoons Guards, popularly known as the Bays, and 10th Hussars went into battle side by side at El Alamein on 23 October. Just before daylight, the Bays lost three Shermans to mines before a troop destroyed a German anti-tank gun. Two more tanks were then immobilised by mines. Later that morning, the Bays' B and C Squadrons advanced with infantry on their flanks and A Squadron, 10th Hussars, to the rear. The British Shermans charged more than 20 German tanks and destroyed half of them in a swirling fight. During the remainder of Montgomery's offensive the Sherman played a key role.

Meanwhile, the first Shermans in action with American forces landed in North Africa during Operation Torch on 8 November 1942. The inexperienced U.S. soldiers took heavy losses; on 14 February 1943 a contingent of 51 Shermans of the 3rd Battalion, 1st Armored Regiment, lost 44 of its tanks in a savage encounter. At the village of Sidi Salem, a Sherman destroyed a pair of enemy tanks, and west of the town a platoon of Shermans ambushed four PzKpfw IVs and knocked out two of them.

CRITICAL ASSESSMENT

These early examples of the Sherman in combat were assessed with mixed conclusions. While the 75mm gun was potent enough to take on enemy tanks then in the field, the illusion that tank-versus-tank combat would seldom occur was shattered. In the process, the speed of the Sherman, its ease of maintenance and its growing numbers as U.S. industrial output increased were counterbalanced by the thin armour protection that obviously had a negative impact on survivability. Casualties among the Allied tankers were severe, and the thin skin of the Sherman bore the brunt of the criticism.

As the war progressed, the appearance of heavier German tanks with bigger main weapons, including the PzKpfw V Panther and PzKpfw VI Tiger, with high-velocity 75mm and 88mm main weapons and thick armour plating, put the Sherman at a disadvantage, both in protection and the penetrating power of its gun. When a Sherman 75mm round struck home it was often just powerful enough to attract the enemy's attention rather than penetrate into the

German tank's extremely tough hide, and the installation of the more powerful main weapons in the Sherman turret therefore became a necessity.

The Germans respected the M4, but even they observed its propensity to catch fire, nicknaming the Sherman the

'Tommy Cooker' in reference to the slang term for the British soldier, the Tommy. American tankers began to refer to the Sherman as the 'Ronson', alluding to advertising for a popular cigarette lighter of the period. The Ronson slogan, "Lights up the first time, every time!", indicated the grim humour with which its operators climbed aboard. Polish tank soldiers who operated the Sherman called it the 'five-man cremation device', and Soviet soldiers referred to it as the 'burning grave'.

In the final analysis of combat in North Africa and Western Europe, the Germans were simply overwhelmed by the number of Sherman tanks they confronted. The Panthers and Tigers were heavy, over-engineered and prone to mechanical failure due to inadequate powerplants. They were precision weapons and could never be produced in sufficient quantities to take long-term control of the battlefield. In contrast, the Sherman was reliable, fast, mass-produced and available in large numbers by 1943–44.

THE WAR WEARS ON

Ten battalions of the DD Sherman tank were allotted to the D-Day landings in Normandy on 6 June 1944, and they did play a key role in supporting the establishment of the Allied foothold on Gold, Juno, Sword, Omaha and Utah beaches. However, the weather in the English Channel was rough, and most of the DD tanks were required to come ashore under their own power after being discharged from landing craft approximately three kilometres (two miles) off the beaches.

In the event, eight DD tanks were swamped in heavy seas and failed to reach Gold, but those that did – of the 7th Royal Dragoon Guards and the Sherwood Rangers Yeomanry – blasted German pillboxes and machine gun nests to facilitate inland movement. At Juno, 21 of 28 DD Shermans of the Canadian 1st Hussars moved off the beach rapidly with vital fire support. Twenty-seven DD Shermans waddled ashore at Utah, assisting the 4th Infantry Division in its drive, but the DDs off Omaha suffered mightily. A total of 64 Shermans had been allocated to the 741st and 743rd Tank Battalions. Shortly after 29 tanks of the 741st were launched into the roiling English Channel, 27 foundered and sank. The 743rd lost 29 of an initial deployment of 32 at

"TEN BATTALIONS OF THE DD
SHERMAN TANK WERE ALLOTTED
TO THE D-DAY LANDINGS IN
NORMANDY ON 6 JUNE 1944"

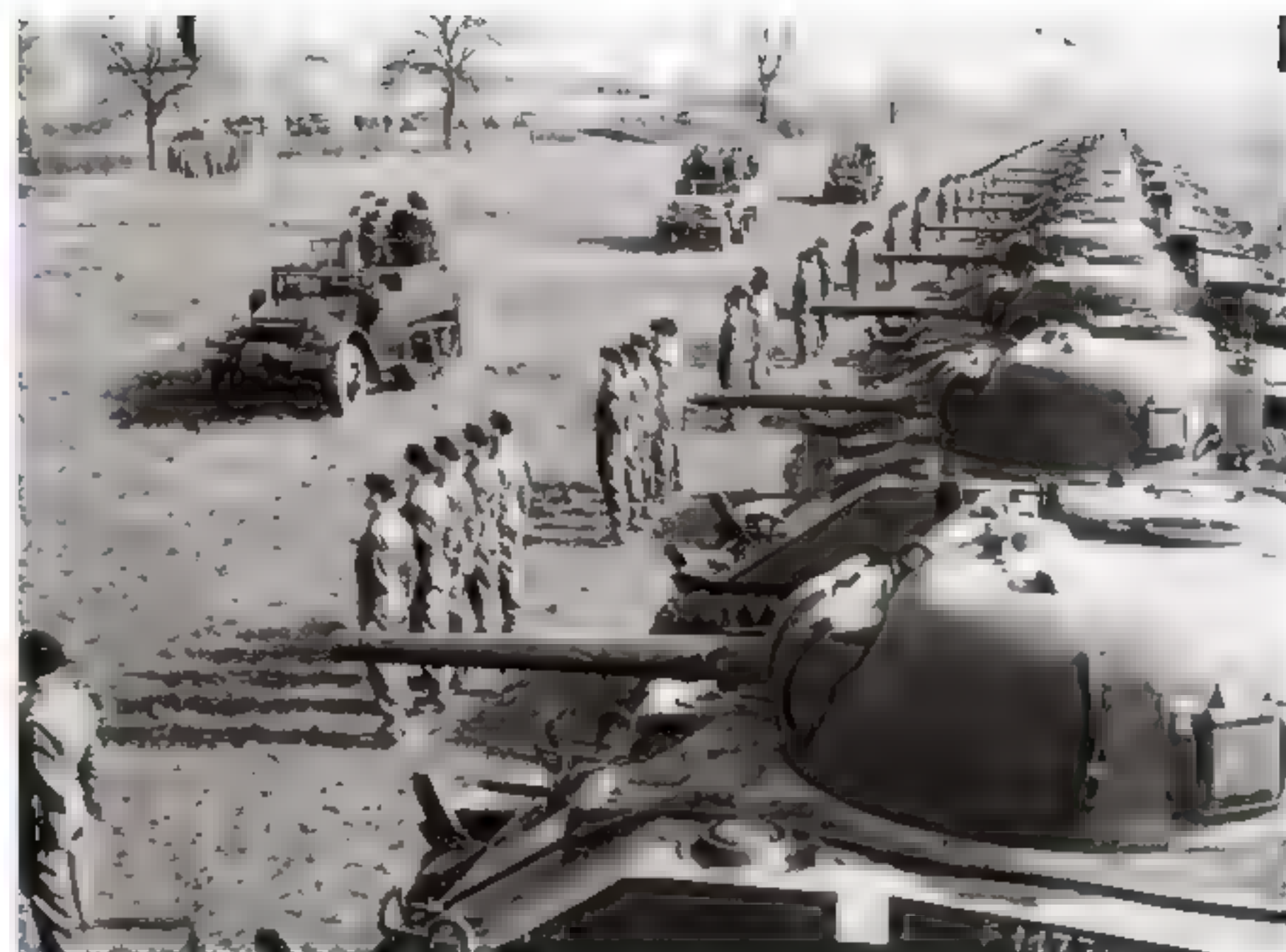
With its propensity to quickly
catch fire when hit, U.S. crews
nicknamed the M4 the "Ronson"
after the cigarette lighter



Anti-mine Shermans were equipped with rotating chain-tipped flails to detonate contact mines and set off magnetic mines



Snow-bound Shermans pictured during a lull in the fighting during the Battle of the Bulge – among Nazi Germany's final offensives in the West



Winston Churchill (in the leading half-track) inspects Sherman tanks and their crews in Yorkshire during preparations for the Normandy landings, April 1944

Omaha, and the remainder of the battalion's DD Shermans were later put ashore directly on the beach.

During the ensuing Normandy campaign, the Sherman tanks that populated Allied armoured formations ran into the heavier Panthers and Tigers of the Wehrmacht and SS panzer divisions that contested the hedgerow country, or bocage, where defences bristling with anti-tank guns and concealed German armoured vehicles made every farm lane a shooting gallery.

When Sherman tanks had difficulty traversing the high earthen mounds of the hedgerows, a battlefield modification assisted in the effort. Sergeant Curtis Cullin of the U.S. 102nd Cavalry Reconnaissance Squadron suggested welding steel blades to the front of the Sherman hull, allowing the tanks to dig into the hedgerows and plough through them. Hundreds of tanks were modified in this manner.

During the fighting for the French crossroads and communications centre of Caen, a D-Day objective that took six weeks for forces under Montgomery to capture, the British infantry and armour slugged it out with German tanks, losing scores in pitched battles but eventually taking the town. Meanwhile, as the British fought the bulk of German armour, the Americans executed Operation Cobra, the breakout from Normandy in the vicinity of Saint-Lo.

When the U.S. Third Army, under General George S. Patton, Jr., emerged into the open plain of Brittany, ideal tank country, the Sherman was at its best. Speed and mobility paid dividends as the Third Army dashed across

France. Even so, there were heavy losses, and while the machines destroyed in combat could be replaced, the casualties were frightful at times, and many an Allied soldier lost his life riding a Sherman into combat.

In the autumn of 1944, the Sherman spearheads of the British XXX Corps tried to link up with airborne troops in Holland during Operation Market Garden, but the advance along a single road was slow. German anti-tank guns took a fearful toll on XXX Corps' Shermans, and the thrust intended to advance into the Ruhr, the industrial heart of Germany, ended in failure.

To the south, in September, the Battle of Arracourt saw American Shermans fighting factory-fresh German Panthers. Despite their advantage in tank-versus-tank engagements, the German crews were not thoroughly trained and the Panthers were handicapped by limited reconnaissance prior to the fight, which degenerated into a brawl. When Panthers breached the line of Combat Command A, 4th Armored Division, the Americans responded with a flanking manoeuvre that accounted for the destruction of 11 Panther and PzKpfw IV tanks. When inclement weather cleared, fighter bombers of the XIX Tactical Air Command blasted any German tank left in the open. When the Battle of Arracourt ended, the Germans had lost nearly 90 tanks, with dozens more sustaining damage. The 4th Armored Division counted 41 wrecked Shermans.

In December 1944, the Germans launched Operation Wacht am Rhein, which resulted in the Battle of the Bulge.

Shermans in the North Rhine-Westphalia region of Germany, November 1944. The fast tank was at its best in flat, open terrain



As the German spearheads directed toward the Belgian port of Antwerp were blunted, the Sherman played a key role in reducing the panzer penetration of the American lines through the Ardennes Forest. When Third Army pivoted northward to relieve the encircled crossroads town of Bastogne, Belgium, elements of the 4th Armored Division, Sherman tanks forward, made contact with the 101st Airborne and Combat Command B, 10th Armored Division, which had held Bastogne against long odds.

In the Pacific, the Sherman generally dominated combat against inferior Japanese tanks mounting smaller-calibre main weapons. The Sherman also performed well in open space, although such opportunities were limited in the confines of jungle and island fighting. Nevertheless, when it was deployed the tank's 75mm gun was instrumental in destroying Japanese bunkers and machine gun nests, notably during operations at Tarawa in 1943, as well as the Marianas, Philippines, Iwo Jima and Okinawa in 1944–45.

BATTLEFIELD BURDEN

While the M4 Sherman was providing support for the advance into Germany in the spring of 1945, General Dwight D. Eisenhower, Supreme Commander of Allied Forces in Europe, had become aware of the glaring shortcomings of the tank. He wrote a letter to subordinate commanders asking for assessments of its performance. It read in part, "Our men, in general, realize that the Sherman is not capable of standing up in a ding-dong, head-on fight with a Panther. Neither in gun power nor in armour is the present Sherman justified in undertaking such a contest. On the other hand, most of them realize that we have got a job of shipping tanks overseas and therefore do not want unwieldy monsters; that our tank has great reliability, good mobility, and that the gun has been vastly improved."

General Maurice Rose of the 3rd Armored Division wrote back: "It is my personal conviction that the present M4 and M4A3 tank is inferior to the German Mark V... The fact... is borne out by the excessive number of losses we took while fighting in Belgium in December and January."

Staff Sergeant Harry Wiggins, a frontline tanker of the 33rd Armored Regiment, noted, "I have fired at 150 yards at a Panther... without penetration. This of course was at the front of a Panther, with a 75mm. We manage to get within effective range of German tanks because they are generally hiding or camouflaged and we try to engage them within a couple of hundred yards."

The American and British tankers did benefit from improved firepower as modifications to the main guns were completed, and they developed tactics that suited their numerical advantage. Eventually, the Sherman gained the edge in a war of attrition. From the German perspective, there were simply too many of them.

Still, men's lives were sacrificed with the Sherman. Belton Y. Cooper, a veteran of the 3rd Armored Division, penned a controversial postwar book titled *Death Traps: The Survival of an American Armored Division in World War II*. He asserted, "We lost 648 medium tanks. We had another 700 repaired and put back into action. When you compare that to the 232 we had when we landed at Normandy, I don't know of any other division or service that took that kind of loss." Cooper estimated the 3rd Armored Division's loss rate in tanks at 580 per cent.

Contemplating whether or not the Sherman tank was a war winner during the course of WWII, the answer depends upon the individual's perspective. The Allies prevailed, and the Sherman contributed to the victory – but at a considerable price.

M4 EPILOGUE

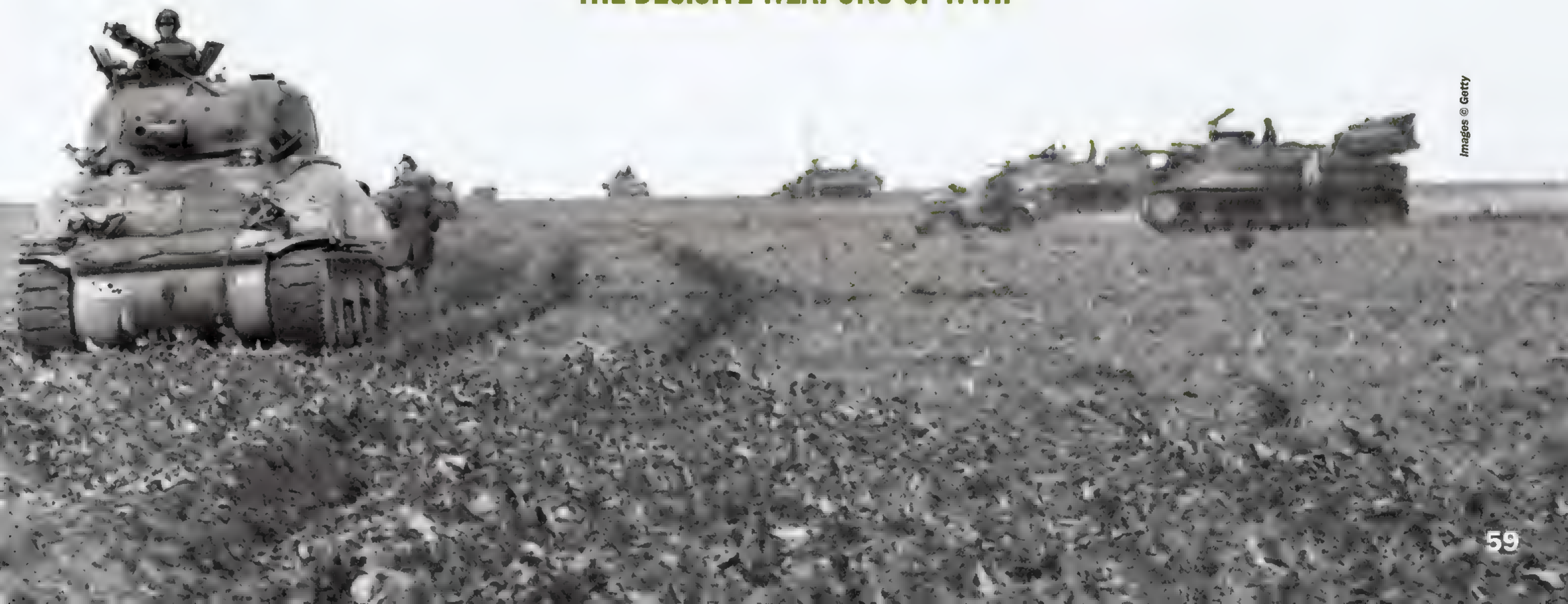
While the M4 Sherman's performance in WWII remains the subject of vigorous debate, the tank itself recorded a remarkable service life of more than half a century. By the late 1940s, surplus Shermans were in action with the forces of the fledgling nation of Israel, and Israeli engineers went on to upgrade the tank to configurations collectively referred to as the 'Super Sherman'. These improved variants were available to the Israeli armed forces into the 1970s.

M4 variants were active with UN forces during the Korean War alongside newer types and fared predictably poorly in combat against the Soviet T-34s in service with the North Koreans, although their performance in infantry support was solid. In 1959, Cuban revolutionary Fidel Castro rode into Havana atop a Sherman, and India and Pakistan fielded the tank during their wars of the 1960s and 1970s.

In more than 50 years of service, the Sherman was used by the armed forces of dozens of countries. Although one may still be operational somewhere, the last known Sherman used in combat was an M4A3 with the Nicaraguan National Guard in the 1978–79 Sandinista Revolution.

The topic of both praise and scorn, the M4 Sherman medium tank remains one of the decisive weapons of WWII and an icon among 20th-century armoured fighting vehicles.

"THE TOPIC OF BOTH PRAISE AND SCORN, THE M4 SHERMAN MEDIUM TANK REMAINS ONE OF THE DECISIVE WEAPONS OF WWII"



TIGER I

One of the most advanced Axis panzers of WWII, the Tiger I struck fear into the hearts of Allied tank divisions everywhere

Between August 1942 and the fall of the Third Reich in May 1945, approximately 1,500 Panzerkampfwagen VI Tiger Ausf.E were manufactured by the Nazi war machine.

Renowned for its accuracy and strong armour, this heavy tank was a formidable foe to the Allied forces. It outclassed many of the Sherman tank models in several departments and tales told from the war have described 75mm rounds bouncing straight off the Tiger's solid armour.

The tank saw its first action in September 1942 as the Third Reich advanced eastwards

during Operation Barbarossa. In an engagement near Leningrad, four Tigers managed to dispatch 24 Soviet T-34 tanks. In fact, the Tiger only floundered when it ended up becoming stuck in the harsh conditions of the Russian winter, where its caterpillar tracks would be repeatedly trapped in the dense, frozen mud of Eastern Europe. This meant the nimble T-34 could



PANZERKAMPFWAGEN VI TIGER AUSF.E

COMMISSIONED: 1942

RANGE: 4.9 KM (3.1MI)

CREW: 5

ENGINE: MAYBACH HL210 P45

ARMOUR: ELECTRO-WELDED INTERLOCKING

NICKEL-STEEL PLATES

PRIMARY WEAPON: 88MM CANNON

SECONDARY WEAPON: 7.92MM MG-34 MACHINE GUNS

now outmanoeuvre the Tiger and strike where its armour was weakest. The Allies had no answer to the sheer power of Panzerkampfwagen VIs until the development of the Sherman Firefly in 1943, which finally matched Tigers pound-for-pound. Before this, only wave after wave of Shermans and T-34s could bring about the downfall of a Tiger.

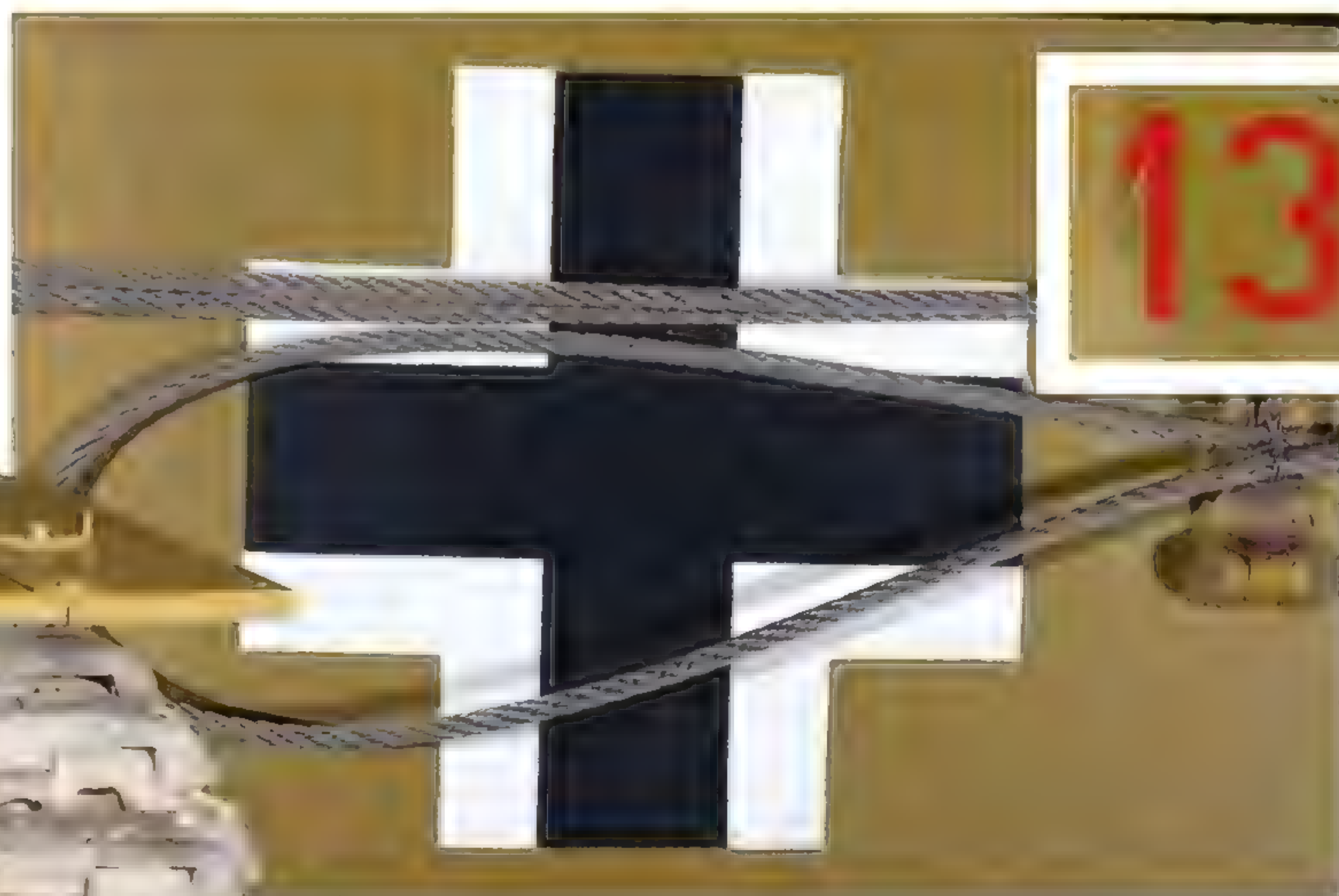
By 1944, German factories had hurried the Tiger II into production and the number of Tiger Is dwindled. Contemporary reports suggest that the Tiger I was over-engineered and, towards the latter stages of its lifespan, rushed off the production line as the Germans desperately tried to save the war.

“THE ALLIES HAD NO ANSWER TO THE SHEER POWER OF PANZERKAMPFWAGEN VIs UNTIL THE DEVELOPMENT OF THE SHERMAN FIREFLY”



A Tiger I tank rolling across the battlefields of Europe was a frightening sight for any Allied soldier

Bundesarchiv, Bild 101I-299-1805-16 / Scheck / CC-BY-SA



Above The tank sported insignia showing its battalion and allegiance to the German Wehrmacht.

This particular model was found abandoned in the North African desert

Right The Tiger I was reliable mechanically but was let down by over-engineering and the harsh conditions of the Eastern Front



Bundesarchiv, Bild 101I-022-2936-27 / Altvater / CC-BY-SA

88MM GUN

The main weapon of the Tiger could shatter the defences of Allied tanks and fortifications. The 88mm gun could penetrate 100mm of armour from up to 1,000 metres (3,280 feet) away. On the battlefield, the Tiger would be strategically placed on hilltops to make use of its cannon's long range while being protected from enemy fire by its thick armour.



Above: The panzer's ammunition varied from armour-piercing shots to high-explosive and incendiary rounds

Bundesarchiv, Bild 183-J14931 / Rottensteiner / CC-BY-SA.jpg

The huge 88mm Panzergranate 39 gun dwarfed the Allied M4 Sherman cannon and was originally an anti-aircraft gun



CATERPILLAR TRACKS

The tracks fitted on a Tiger were extremely wide. This helped the bulky 57-ton tank traverse over boggy ground as well as spreading the weight more thinly to cross bridges. Despite this, the Tiger was the victim of adverse weather conditions on the Eastern Front as frozen mud wedged itself within the tracks. The lightweight Soviet T-34s didn't experience this problem as frequently and were able to outflank the German tanks, particularly at the Battle of Kursk, the biggest tank battle of all time.



SECONDARY WEAPONS AND AMMUNITION (TWO 7.92 MG-34 MACHINE GUNS)

As well as its main cannon, the Tiger was fitted with MG-34 or MG-42 machine guns. A Tiger tank would have one next to the driver at the front of the tank and on some models an MG would be attached to the top of the vehicle. These machine guns could reach distances of up to 400 metres (1,312 feet) and 5,850 rounds would be kept aboard to cut down swathes of infantry and light vehicles.

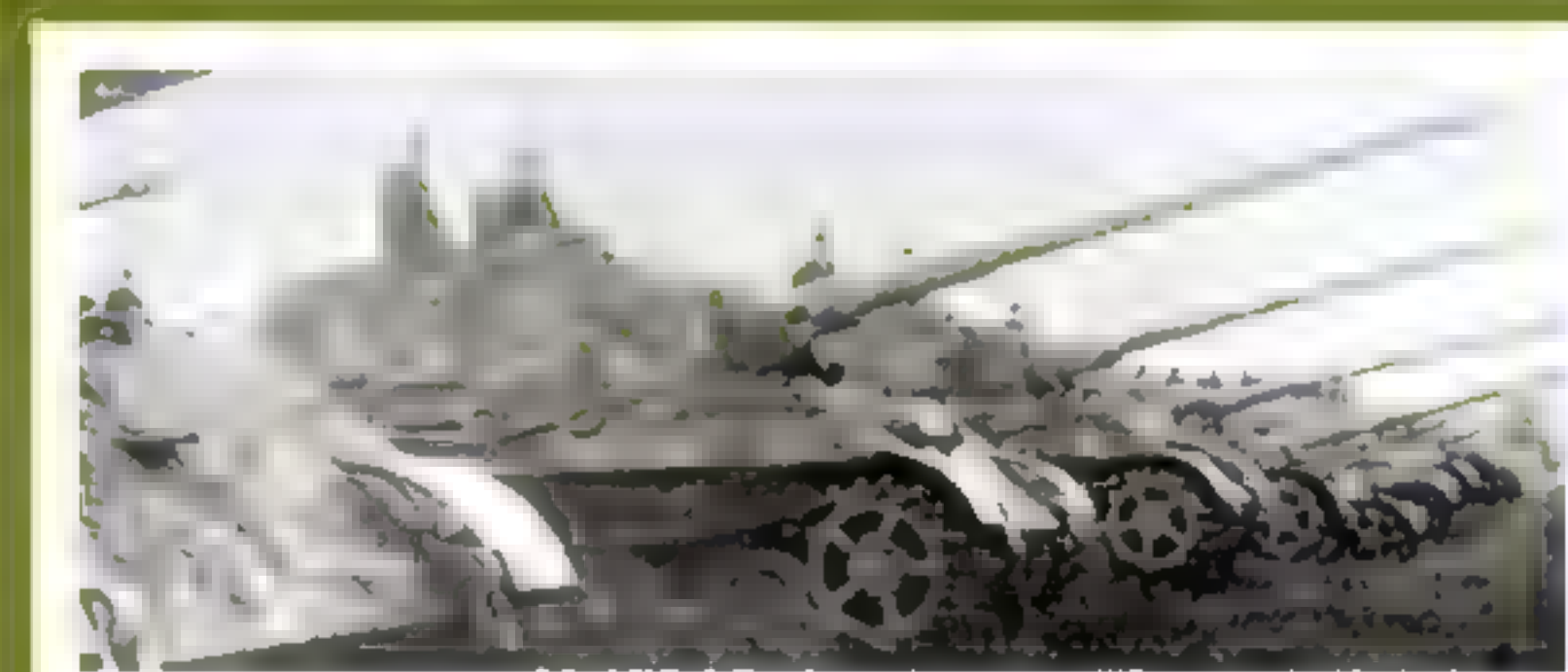


THE TIGER II

THE TIGER WASN'T THE MOST FEARSOME OF THE NAZI PANZERS. THE TIGER II WAS BIGGER, STRONGER AND BETTER PROTECTED

MAIN GUN

The Tiger II's main gun packed a marginally more powerful punch than the Tiger I as it could penetrate 182mm of armour at double the distance. This was also further than Allied tanks of the period. Known informally as the Königstiger, only 492 of these mighty machines were made.



ARMOUR

The armour was nearly 200mm thick on the Tiger II, significantly thicker than its predecessor. The Allies tried to create equivalents, but tanks like the American T29 were not ready for WWII. The Tiger IIs were rushed into production and were often hampered by ill-suited engines.



KING-SIZE

The Tiger II was a heavy tank and its bulk was even larger than the Tiger I. The original Tiger already had issues with its engine and the larger size of the Tiger II only compounded these problems. Only in use at the tail-end of the war, we will never know how it could have contributed to the earlier stages of the conflict.



INTERIOR

The Tiger's small enclosed interior contained a crew of five: a gunner, loader, driver, commander and a radio operator. Although small, the Tigers were over-engineered by their manufacturers, so the interior was packed with modern sighting equipment, weapons caches and tools. The drivetrain was aided by hydraulic-power-assisted steering and the entire mechanism was powered by four batteries. The whole tank was so advanced that when it was captured by the British it was inspected by Winston Churchill and George VI and then taken back to Britain for extensive testing.

Despite its large exterior, the inside of a Tiger was a cramped place where fires were a frequent problem

Below: The Germans insisted on using a 641-horsepower, 21-litre (4.6-gallon) petrol Maybach HL210 engine in their Tiger I tank

Below: The panzer contained an escape hatch if the main lids were under fire or had been blown off



As well as the 88mm and the MG-32 machine gun(s), the Tiger also had two sets of three smokescreen canisters to conceal it and cause confusion

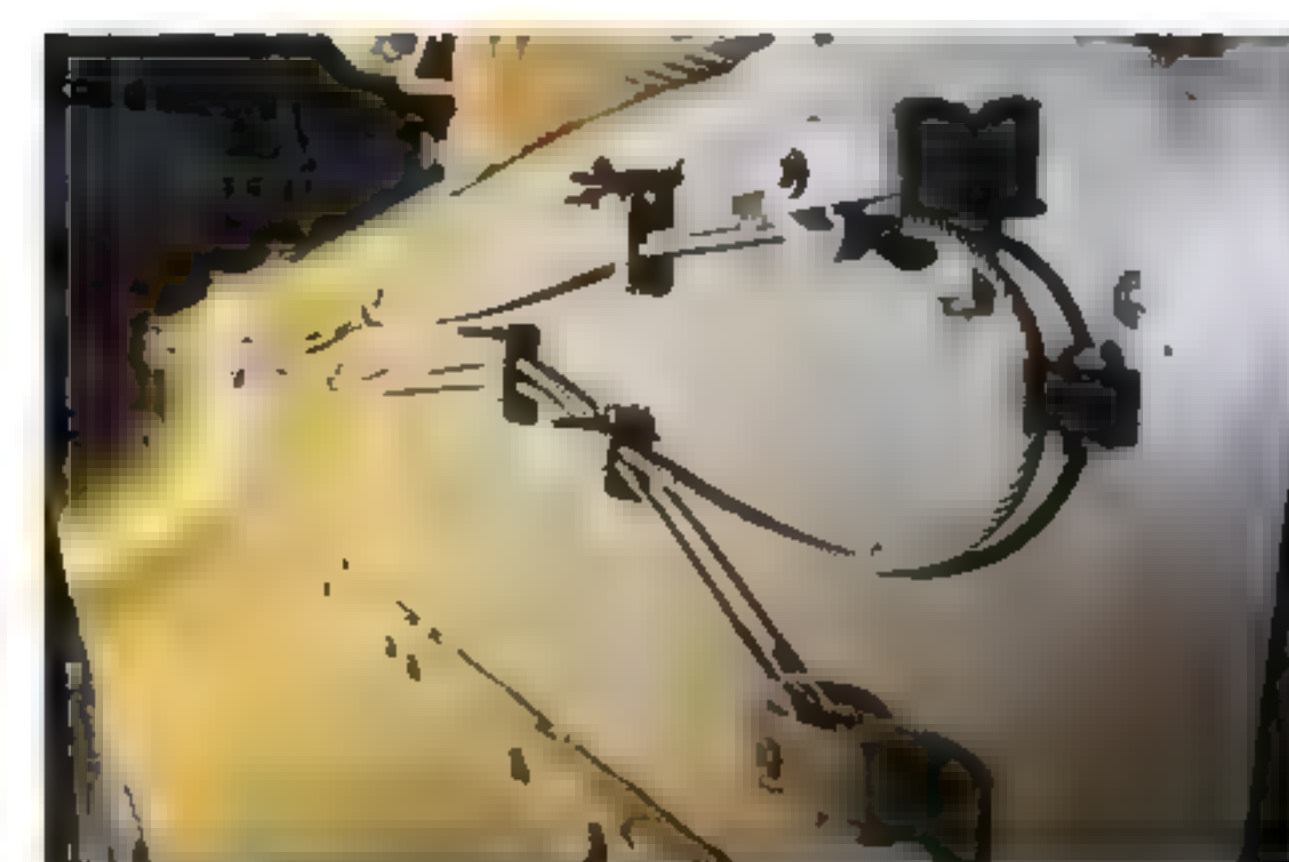


The Tiger had a complex exhaust system on its rear to increase power

THE TIGER 131

This Tiger model was part of the 504 Schwere Panzer Battalion in North Africa and was one of the very few not to have been destroyed by its own crew. Forensics and analysis have shown that the Tiger was hit several times by British Churchill tanks but none disabled the tank. The main damage was dealt just underneath the barrel and wedged the turret to the hull. This stopped it from working, but it could easily have been repaired by the crew. This makes it even stranger that the crew abandoned it and didn't destroy it as they were instructed to. It's the only working Tiger currently in existence and was featured in the 2014 film *Fury*.

Below: The well-engineered Tiger was a box of tricks and had cables and even a spade to help retrieve it from sticky situations





The massive 88mm gun could take out almost everything on the battlefield

TIGERS? WHAT ABOUT PANTHERS?

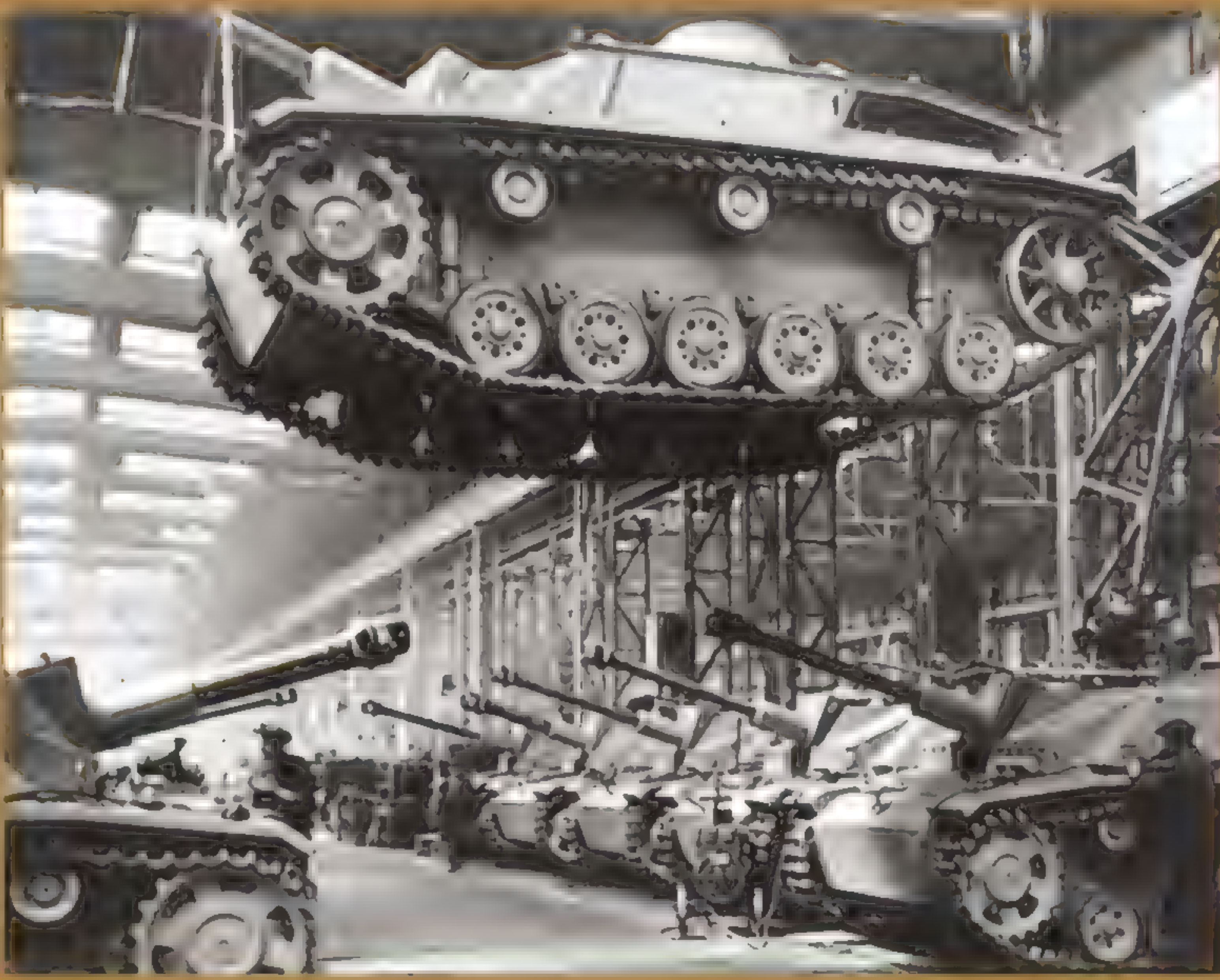
Just below the heavy Tiger tank in the power stakes was the medium Panzer V, or Panther tank. An excellent all-rounder, it had top-of-the-range capabilities in everything from speed to firepower and manoeuvrability. The idea for the Panther came after the previous model of Panzer IV tanks were outclassed on the Eastern Front by the Soviet T-34. The Wehrmacht captured the Red Army's prize tank and got to work creating a better alternative. The Panther was born as a result. One of the Panther's first battles was at Kursk. Plagued by mechanical issues, it did not perform well in its first acid test, as the Wehrmacht lost out to the Red Army in what was the largest tank battle of all time. After this initial setback, however, the Panzer V went from strength to strength and accounted for almost half of the German tanks on both the Western and Eastern fronts. Like the Tiger, it consistently outclassed both the M4 Sherman and the original T-34, but it ultimately fell foul of the overwhelmingly superior Allied numbers, as well as the development of large guns to help effectively combat them.



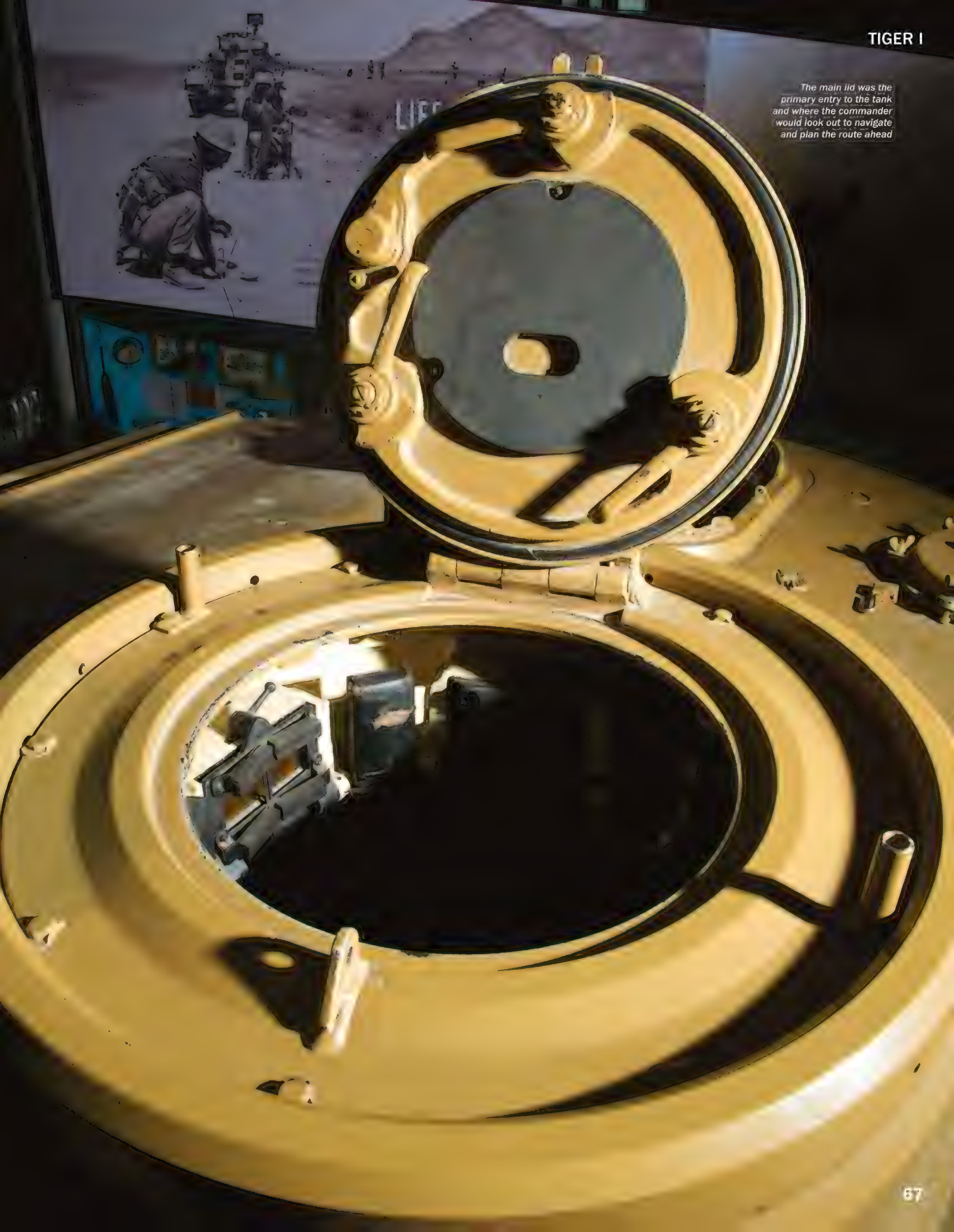
Above: According to many historians, the Panther was the best tank of WWII

THE THIRD REICH PRODUCTION LINE

The Third Reich's production line during World War II was a marvel of industrial organization. It was a complex system that allowed the German war machine to produce vast quantities of tanks, aircraft, and other military equipment. The production line was spread across several large factories, including the Volkswagen factory in Wolfsburg, which was famous for its production of the Volkswagen Beetle. The production line was also spread across several smaller factories, which produced various components and sub-assemblies. The production line was a key factor in the success of the German war machine during World War II.



The main lid was the primary entry to the tank and where the commander would look out to navigate and plan the route ahead



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HITLER'S TIGER AGE

Michael Wittmann, a.k.a. the Black Baron, was a hugely successful panzer commander and propaganda icon for the Nazis. His role in the brutal Waffen-SS left a dark legacy

WORDS JON TRIGG

© Alamy

Born in Bavaria on 22 April 1914, Michael Wittmann would go on to become the most famous Waffen-SS Tiger Ace (a panzer commander credited with multiple kills, also called a 'Panzer Ace') of WWII. First in the Soviet Union and then most famously at the Battle of Villers-Bocage on 13 June 1944, in Normandy, he would win fame and glory before his death in combat on 8 August that same year. Feted by the Nazi propaganda machine, his legacy is a controversial one, with historians casting doubt on his achievements and abilities as a panzer commander.

Wittmann was born a farmer's son but didn't follow in his father's footsteps: he opted for a military life and in 1934, aged 20, enlisted in the army. Having served for two years, Wittmann – also a member of the Nazi Party – made the decision to transfer to the still-infant Waffen-SS. He was assigned to Hitler's own bodyguard, the Leibstandarte SS Adolf Hitler (LSSAH), a motorised infantry regiment, and following the outbreak of war he fought with the Leibstandarte in the invasions of Poland, France and the Balkans. By then he had been promoted to NCO rank, but his career only really took off when Hitler unleashed Operation Barbarossa – the Nazi invasion of the Soviet Union on 22 June 1941.

A small number of self-propelled assault guns had been incorporated into the LSSAH as far back as April 1940, although they were not formally recognised as a sub-unit until after the defeat of France. By the time of the

invasion the LSSAH boosted the strength of a division but wasn't officially designated as such until the end of 1941. Regardless, it contained a full battalion of self-propelled StuG III assault guns, one of which was commanded by Wittmann. As part of Gerd von Rundstedt's Heeresgruppe Süd (Army Group South) Wittmann took part in Barbarossa's huge advances that summer and was awarded the Iron Cross First Class.

Having captured the major city of Rostov-on-Don, the LSSAH was forced to retreat by the Red Army's winter counteroffensive and was severely mauled in the process. Erwin Bartmann, a member of the LSSAH at the time, recalled, "On 2 December we had to evacuate Rostov... the enemy being too strong for us... it was a wild retreat, we had to get out as soon as possible." With the arrival of spring, Bartmann described how "the Russian propaganda loudspeakers wished us a pleasant stay in France – that's how we first learned we were to be withdrawn

**"THE SMELL OF BURNING FLESH
WAS TERRIBLE AND IT WAS
DISTRESSING TO HEAR THE
SOUND OF MEN BURNING TO
DEATH IN THEIR TANKS"**

from the Russian front... for refitting and reorganisation". Leaving Russia for France in June 1942, Wittmann was selected for officer training and sent to the SS academy at Bad Tölz in Bavaria.

KURSK AND THE TIGER

After successfully passing his officer course, Wittmann returned to the LSSAH and was subsequently given command of a new Tiger I tank. This was one of the stand-out tank designs of the war, having enormously thick frontal hull and turret armour measuring 100mm, and the superlative 8.8cm KwK 36 gun. It was in the Tiger that Wittmann would become one of Germany's 'Panzer Aces', as he and his exceptional crew – especially his gunner, Balthasar 'Bobby' Woll – exploited the Tiger's superb protection from enemy fire, and its tank-killing main gun, to maximum effect.

After the disaster of the Battle of Stalingrad (August 1942 – February 1943) Hitler decided on a new offensive to recapture the initiative in the east and crush the Red Army. Operation Citadel was designed as a huge pincer attack involving the majority of Nazi Germany's armoured strength on the Eastern Front, and Wittmann's LSSAH would play a prominent role as part of Erich von Manstein's Army Group South. Significant faith was placed by the Germans in the ability of the new Tiger and Panzerkampfwagen V Panther tanks to smash the Soviet defences and break through to the objective – the city of Kursk. However, the new



SS-Obersturmführer Michael Wittmann (far left) and his crew stand in front of their Tiger I in Russia, 15 February 1944. Note the multiple 'kill rings' on the Tiger's gun. Bobby Woll – Wittmann's gunner and fellow Knight's Cross winner – is second from left



Wittmann (centre) shortly after his demolition of the British offensive at Villers-Bocage in June 1944. On the left is Josef 'Sepp' Dietrich, and on the right is Dietrich's adjutant, SS-Hauptsturmführer Hermann 'Bibi' Weiser



Wittmann receives the Eichenlaube (Oakleaves) to his Knight's Cross from Adolf Hitler at the Wolf's Lair, Hitler's headquarters in Rastenburg, on 2 February 1944. He would receive the Schwerter (Swords) on 22 June

vehicles had been rushed into service without the proper tests and trials, and suffered from significant problems.

In particular the Panther was prone to technical issues and breakdowns. These engineering issues, combined with the advancing Germans having to fight through line after line of Soviet defences constructed in depth, resulted in major casualties and robbed the offensive of its momentum. Werner Block, from Hamburg, who was the driver of a Tiger at the time, recounted how “the smell of burning flesh was terrible and it was distressing to hear the sound of men burning to death in their tanks”. After only eight days Hitler called off the Kursk offensive.

The Germans had suffered a major defeat in what would turn out to be their last great summer offensive in the East. Wittmann had fought in the battle with the 13th Heavy Tank Company of the Leibstandarte’s 1st SS Panzer Regiment, and despite the eventual rout at the hands of the Soviets his performance enhanced his reputation. With an experienced crew and a main gun able to destroy a T-34/76 (the main battle tank of the Red Army) at a distance of 1,500 metres (4,921 feet), Wittmann had claimed 30 kills and was duly awarded the Knight’s Cross of the Iron Cross.

Wittmann pictured in northern France prior to Operation Overlord



© Alamy

German paratroopers advance with the support of Tigers from the 1st SS Panzer Division LSSAH on the Eastern Front, 1944



© Alamy

ENDGAME IN THE EAST

With the cancellation of Operation Citadel, the LSSAH was despatched to Italy after the Allied landings in Sicily. Re-equipped once more and redesignated a full panzer division, the LSSAH then headed east again and was involved in the heavy defensive battles at the end of 1943 and the beginning of 1944. During this time Wittmann was awarded the Oak Leaves to his Knight’s Cross from Hitler himself for achieving 117 tank kills overall. Shortly after, Wittmann and the LSSAH were en route west for yet another reorganisation as Nazi Germany prepared for the anticipated Allied invasion of France.

In April 1944, having been promoted to SS-Obersturmführer (senior lieutenant) and given command of a company of 12 Tigers, Wittmann was based in Beauvais, northwest of Paris, as part of the 101st SS Heavy Panzer Division. When the Allies landed in Normandy on D-Day the battalion had 37 of its 45 Tigers operational and was ordered to the front, struggling through frequent air attacks and breakdowns to reach the battle days after the landings. On arrival it was immediately ordered into action to try and stem a dangerous British breakthrough to the strategically vital village of Villers-Bocage. As Kurt ‘Panzer’ Meyer – a famed regimental commander in the 12. SS-Panzerdivision Hitlerjugend – declared, “If a breakthrough of the German front succeeded the defence of Caen would be lifted off its hinges.”

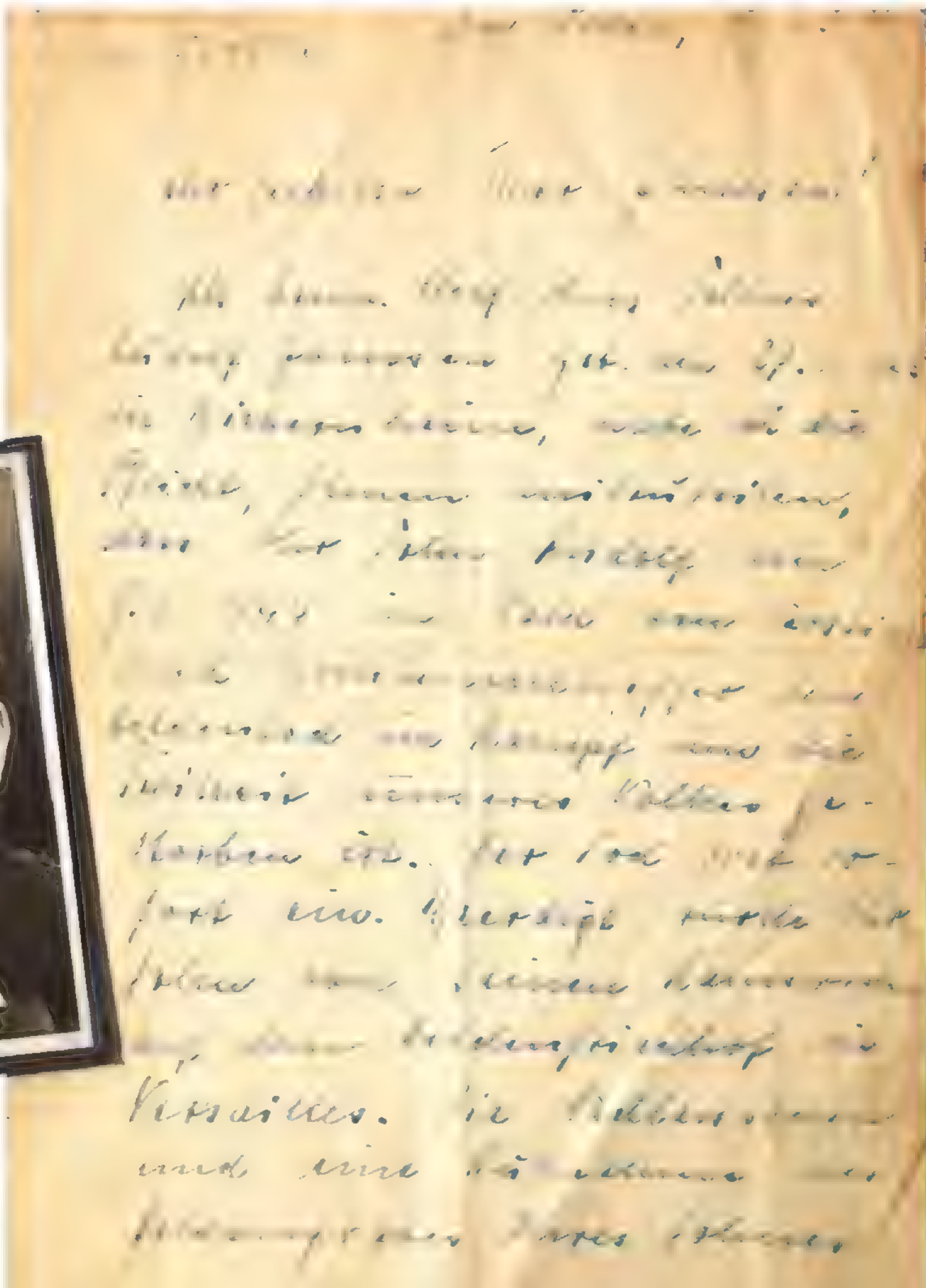
VILLERS-BOCAGE

On the morning of Tuesday 13 June, with only six of his company’s Tigers operational, Wittmann advanced to find the British 7th Armoured Division – the Desert Rats – already in possession of the town. Leading the British advance was a mixed battle group of County of London Yeomanry tanks and mechanised infantry from the Rifle Brigade. Wittmann decided to attack alone and fought perhaps the most famous panzer engagement of the war.

Having taken the village without resistance earlier that morning, the British were regrouping when Wittmann – himself having been taken by surprise by the British arrival – launched an attack. Ordering the rest of his company to stand their ground, he took his own Tiger forward. Accounts of the action are disputed, but what is clear is that Wittmann caught the British unawares and proceeded to wreak havoc among the stationary tanks, guns and vehicles.

The British scrambled to react as Wittmann’s Tiger fired shell after shell into their ranks and swept the battlefield with machine-gun fire. British Churchill tanks, trucks and Bren-gun carriers went up in flames as fleeing

Below: Wittmann wrote to the father of Rudolf Janssen that his son had been killed by a direct bomb hit on 8 June 1944 in the wood of Versailles, dying “a heroic death fighting for the freedom of our nation” and that “we will continue to fight for him”. It is dated “In the west, 22 June 1944.” Below inset: A photograph of Wittmann from the Weltbild newspaper of 17 June 1944



101ST HEAVY SS PANZER BATTALION

During the invasion of the Soviet Union in 1941 the Wehrmacht's tank force, the Panzerwaffe – hitherto almost invincible – was shocked by Soviet tanks like the T-34 and KV series, which were superior to their own. Germany responded by developing bigger panzers with hugely powerful guns able to destroy enemy tanks at huge distances while sporting armour so thick they were almost invulnerable. This was the genesis of the Tiger.

Expensive and time-consuming to manufacture, only 1,347 Tiger I's were produced as opposed to over 80,000 T-34's, so the decision was made to maximise their effectiveness by grouping them in special battalions that would only be used at the most critical sectors of the front. These were christened schwere Panzer-Abteilungen – Heavy Panzer Battalions – of which 15 would be formed by war's end: 12 for the Heer (Army) and three for the Waffen-SS. The first to be created were the Heer's schwere Panzer-Abteilung 501 and 502 in 1942, which fought in North Africa and at Leningrad respectively.

The experiment was not a success. Blighted by mechanical problems and unsuitable terrain, several Tigers were lost, but the Nazis ploughed on and in the summer of 1943 formed the first of its armed SS equivalents: the schwere SS-Panzer-Abteilung 101 (101st Heavy SS Panzer Battalion). Initially intended to be grouped with smaller, faster Panzer III's for flank protection and to then spearhead major offensives, the heavy panzer battalions faced their first major test in

Unternehmen Zitadelle (Operation Citadel) in July 1943. Commonly known as the Battle of Kursk, Zitadelle was intended to swing the war in the east back in Germany's favour after the Stalingrad disaster. The heavy battalions' role was to smash through the Soviet defences and hand Hitler victory.

Richard von Rosen, a Tiger commander, recalled the fierce battle: "Panzer Marsch!... I thought we were through the defences when more than 20 anti-tank guns flashed... never before had

we come across such a concentration of firepower." The Red Army was too strong and the heavy panzer battalions failed. From then on the deteriorating situation forced the Germans to use the heavy battalions in a defensive role to try and make up for their lack of numbers. The arrival of even heavier Tiger II's didn't make any difference as the heavies were rushed from crisis to crisis. By war's end they'd destroyed some 9,850 enemy tanks for the loss of 1,715 of their own, a kill/loss ratio of 5.74. It wasn't enough. The experiment had failed.



A Tiger tank pictured in the Bjelgorod-Orel region on the Eastern Front

Images © Getty

"I THOUGHT WE WERE THROUGH THE DEFENCES WHEN MORE THAN 20 ANTI-TANK GUNS FLASHED... NEVER BEFORE HAD WE COME ACROSS SUCH A CONCENTRATION OF FIREPOWER"

Infantry are supported by a Tiger while pressing into a village on the Eastern Front



"IN AN ACTION THAT LASTED JUST A FEW MINUTES, WITTMANN HAD MANAGED TO SMASH THE BRITISH SPEARHEAD AND HALT THE ENTIRE OFFENSIVE"



Hitler inspecting members of
Leibstandarte-SS 'Adolf Hitler',
first incarnation in 1939



infantrymen were mown down. Eventually Wittmann's Tiger was disabled and he and his crew were forced to abandon it and escape on foot. However, in an action that lasted just a few minutes, Wittmann had managed to smash the British spearhead and halt the entire offensive in its tracks.

Exact losses are impossible to pin down, but in all likelihood Wittmann and his crew destroyed a dozen or more tanks, at least that many half-tracks and other vehicles and at least a couple of anti-tank guns. It was a remarkable feat and one that earned Wittmann the Swords to his Knight's Cross.

Seizing on the success, the Nazis made significant propaganda use of Wittmann, interviewing and filming him for newsreels to be replayed back in the Reich. A catchy title was even dreamt up for him – the Black Baron – in reference both to the famous Red Baron fighter pilot of WWI and to the black SS panzer uniform he wore.

THE BARON'S FINAL BATTLE

In the weeks following Villers-Bocage the Allies pounded the Germans from air, land and sea. Manfred Thorn, an experienced Panzer IV driver in the LSSAH, said of the Normandy battles, "The tactic of unbroken artillery barrages lasting for hours was gruesome mental and physical torture." The attritional nature of the fighting took its toll on the Germans, who were gradually losing the initiative to the Allies.

Just over three weeks after his triumph at Villers-Bocage, Wittmann was once more ordered forward to try and blunt yet another Allied offensive, this time near Saint-Aignan-de-Cramesnil. It was 8 August 1944. Kurt Meyer – by now the divisional commander of the Hitlerjugend – recalled how he "shook Michael Wittmann's hand once again and indicated to him the critical situation. Good Michael laughed his youthful laugh and climbed into his Tiger".

Leading a mixed bag of Tigers, Panzer IVs and assault guns, Wittmann advanced and fell

straight into a joint Anglo-Canadian armour ambush. Taken by surprise, his force was badly mauled and Wittman's own Tiger was hit, a tank round penetrating the hull and igniting the on-board ammunition. The resulting explosion was powerful enough to blow off the whole turret. The entire crew was killed.

Nazi propaganda had already turned him into a hero back in the Reich for his exploits in Russia and Normandy, and now his death in combat only served to increase the mystique around him. Still only 30 years old when he died, Wittmann was lauded as one of Nazi Germany's top panzer aces, with Meyer declaring, "One hundred and thirty-eight enemy tanks had fallen victim to him."

However, since the end of the war Wittmann's record and legacy have been the subject of debate. It was – and is – notoriously difficult in combat to ascribe a particular tank kill to a specific tank, and the figure of 138 kills has been disputed, with a number of around 130

VILLERS-BOCAGE & NORMAN TERRAIN

Normandy was a defender's dream in the summer of 1944. Much of its central and western terrain was made up of the famed bocage – a patchwork of ancient fields and orchards surrounded by dense hedgerows built up over centuries by farmers clearing their fields of stones and rocks. In between them was a network of sunken lanes and tracks with little room for manoeuvre, leading to dozens of medieval villages built like fortresses with farmhouse walls several feet thick. The eastern part of Normandy was more open but was dominated by a few prominent pieces of high ground and several ridgelines that provided the

defenders with excellent observation and fields of fire. It was this eastern end of the duchy where much of the Westheer's (the German Army in the West) armoured strength was concentrated.

Villers-Bocage, which was home to around 1,000 people at the time, sat atop one such piece of high ground near the River Odon and more or less astride what was then the main road between Caen and Rennes away to the southwest: the Route Nationale 175. The panzer crews quickly adapted to the terrain, selecting well-camouflaged, hull-down primary positions with long fields of fire and secondary positions on reverse slopes where attacking Allied armour would be silhouetted

against the skyline. At all times it was only the panzers' thick frontal armour that would be exposed to enemy fire.

Commander Richard von Rosen recalled "Soon my panzer was receiving the first hits... my Tiger received a direct hit. We all felt the hefty blow, the lights failed and we were dazed for a few moments... [we were] surprised to find we were all still alive." The Tigers of his company then began spewing fire. "Every round we fired hit a Sherman, which then burst into flames."

No wonder the Sherman crews called their tanks 'Ronsons' given their propensity to catch fire when hit and incinerate the crew.



The Germans were able to utilise the terrain and prepared camouflage to ambush Allied formations



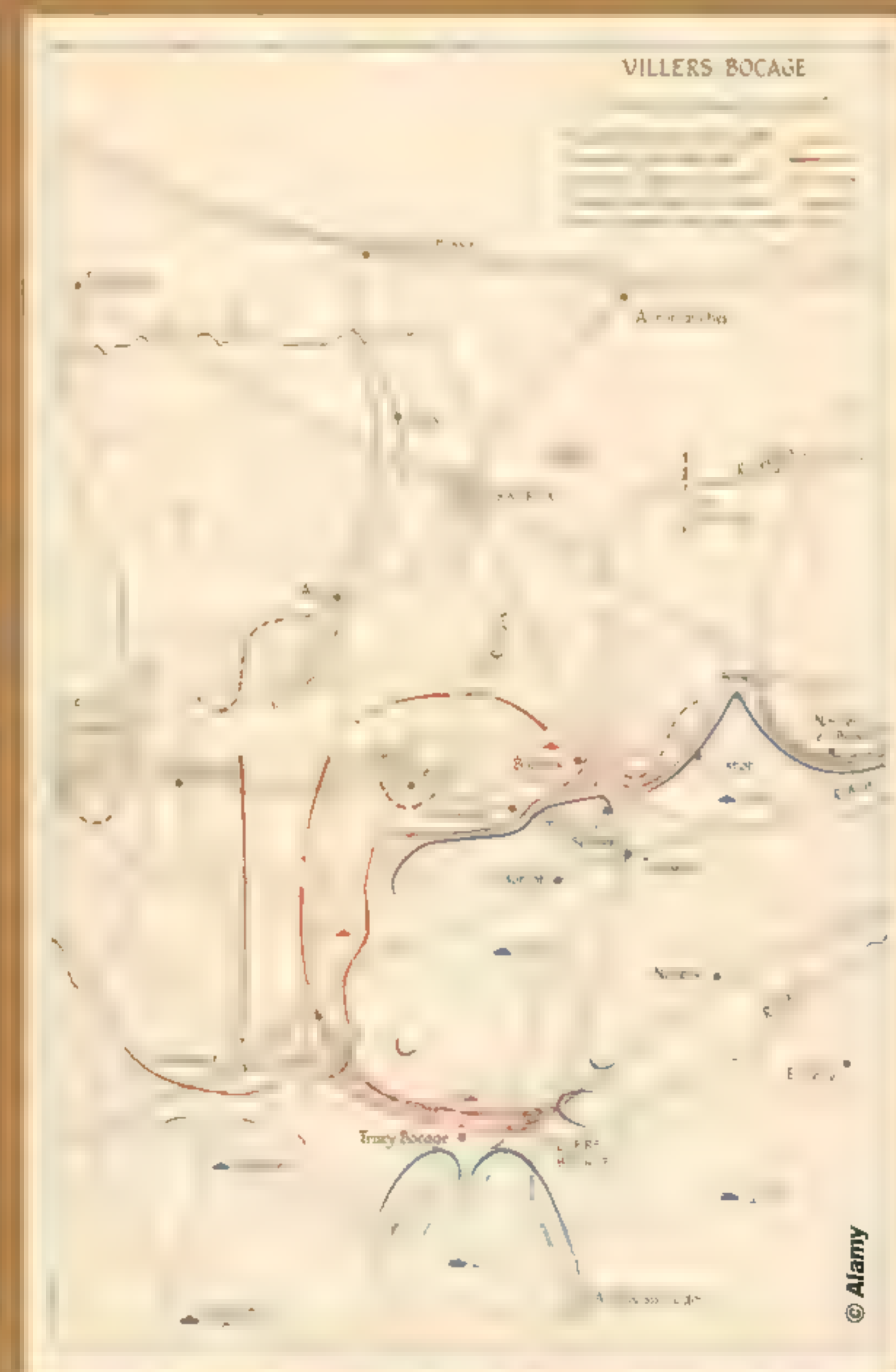
A British Cromwell Cruiser tank, knocked out during the Battle of Villers-Bocage, lays abandoned in the streets



A knocked-out Panzer VI (Tiger I) and Panzer IV sit among the ruined streets of Villers-Bocage after the battle in June 1944



British engineers fill the wreck of a Tiger tank with landmines in order to destroy it after the Allies recaptured the village of Villers-Bocage



A map of the Battle of Villers-Bocage, 1944

becoming the accepted sum. More contentious has been Wittmann's personal reputation, with the military historian Steven Zaloga describing him as "the hero of all Nazi fanboys".

There have also been questions from contemporary historians criticising both the lack of objectivity surrounding his military record and particularly his abilities as a panzer commander. Even his most famous action at Villers-Bocage has been questioned, with conflicting reports about both his decision to attack the town alone and how his own Tiger was put out of action. Why did Wittmann order his company to remain outside the town while he attacked the British spearhead single-handed in what could be described as an extremely foolhardy manner? The same

question could be put to his final action at Saint-Aignan-de-Cramesnil, where a lack of flank protection led to the failure of the attack and his own death.

In the end Michael Wittmann can be assessed as a panzer commander who managed to amass an incredible tally of victories, the vast majority of which were scored on the Eastern Front in 1943, even as Red Army superiority began to tell. Transferred west to face the impending Anglo-American landings in France he – like the rest of the Wehrmacht – faced an enemy which proved more than a match for them and his death, while not inevitable, was unsurprising given the Germans' appalling losses in the Normandy campaign.

"STILL ONLY 30 YEARS OLD, WITTMANN WAS LAUDED AS ONE OF NAZI GERMANY'S TOP PANZER ACES"



Above: LSSAH during the occupation of Milan, 1943

Above right: A Nazi propaganda poster for the LSSAH, 1941

Below: LSSAH panzers on exercise in France, 1944



Operator's Handbook

PANZERKAMPFWAGEN V PANTHER

Perhaps the finest all-around tank of WWII, the German Panther was designed in response to the Soviet T-34

WORDS MIKE E. HASKEW

The appearance of the superb T-34 medium tank in Soviet armoured formations at Mzensk in 1941 came as a shock to German field commanders and led directly to the development of the PzKpfw. V Panther, considered by some military analysts to be the finest armoured fighting vehicle ever to take to the battlefield in WWII.

While research and the development of a tank had been underway since 1937 to replace the PzKpfw. IV, the workhorse of the Wehrmacht and SS armoured formations, the pace quickened following encounters with the T-34. The German Armaments Ministry issued specifications for a medium tank with sloped armour, substantial wheels and tracks for enhanced cross-country mobility, and the capability to mount the long-barrelled 75mm KwK 42 L/70 cannon. Prominent German armaments manufacturers, including Maschinenfabrik Augsburg-Nürnberg AG (MAN), Porsche, Henschel and Daimler-Benz vied for the lucrative contract and submitted designs.

Competition was intense, and in the spring of 1942 the MAN design, known as the VK 3002, was chosen over the Daimler-Benz model. The Henschel and Porsche submissions went on to serve as the basis for the PzKpfw. VI Tiger heavy tank. The PzKpfw. V prototype was completed in September 1942, and a limited production run of 20 tanks preceded authorisation for the first production variant, the Ausf. D, to begin in November.

The exigencies of war brought the Panther from factory to frontline at an astonishing pace, and the lack of adequate testing and evaluation led to disappointing results in the initial combat deployment during the fighting in the Kursk salient in July 1943.

"They burnt too easily, the fuel and oil systems were insufficiently protected, and the crews were lost due to lack of training," reported General Heinz Guderian. These issues were largely corrected in the subsequent Ausf. A and Ausf. G production variants, and the Panther went on to win praise from its crews and earn a fearsome reputation among its adversaries.

CONTROL

The Panther tank's MAN single-radius steering system was operated by levers from the driver position located forward in the hull. The driver was required to judge the distance to a turn and use a combination of appropriate gear and brake to accomplish it. The gearbox was a seven-speed AK 7-200 designed by Zahnradfabrik Friedrichshafen.

ARMAMENT

The primary weapon of the Panther was the long-barrelled high-velocity 75mm KwK 42 L/70 cannon manufactured by Rheinmetall Borsig. Its armour-piercing projectile weighed 7.2kg (16lb) and was specifically designed for the muzzle velocity and pressure of the KwK 42 L/70.

"THE PANTHER WENT ON TO WIN PRAISE FROM ITS CREWS AND EARN A FEARSOME REPUTATION AMONG ITS ADVERSARIES"

TURRET

The Panther turret had already been developed when the tank itself was in the design phase, and numerous alterations were introduced. Its sloped armour offered increased protection against incoming projectiles.

ARMOUR

The armour protection on the top of the Panther tank's three-man turret was 15mm thick, the thinnest in its design. Like other armoured vehicles of its era, the Panther was vulnerable to attack from Allied fighter-bombers.

WHEELS

A double-torsion bar suspension supported the Panther's system of eight steel interleaved road wheels that were rimmed with rubber. The configuration made changing interior road wheels a time-consuming operation, particularly under battlefield conditions.

PZKPFW. V PANTHER

COMMISSIONED: 1942

WEIGHT: 44 TONS

RANGE: 200KM (124MI)

CREW: 5

ENGINE: V-12 MAYBACH HL 230 P30

GASOLINE

ARMOUR: 80mm

PRIMARY WEAPON: 75MM KWK 42 L/70

LONG-BARRELLED CANNON

SECONDARY WEAPON: 2X 7.92MM

MG-34 MACHINE GUNS

"CAPABLE OF PENETRATING UP TO 150MM OF ARMOUR AT A RANGE OF 1,000 METRES, THE KWK 42 L/70 WAS SUPERIOR TO THE MAIN WEAPONS OF MOST ALLIED TANKS"

The Panther's main weapon, the KwK 42 L/70, was a long-barrelled gun that could penetrate 150mm of armour at a range of 1,000 metres. It was superior to the main weapons of most Allied tanks.



DESIGN

The design of the Panther borrowed heavily from the rival T-34. Armour sloped at 55 degrees provided enhanced defence against incoming projectiles, while wider tracks gave better cross-country performance. The suspension included double torsion bars and interwoven road wheels for stability and greater ability to traverse difficult terrain. The Ausf. D included frontal armour protection up to 80mm thick, while side armour varied in thickness from 40–50mm. Weighing nearly 45 tons, it exceeded initial design specifications significantly and approached the anticipated weight of the Tiger tank, although the Panther was much cheaper to produce.

Left: German troops climb aboard a Panther for a ride. Note the exhaust pipe protruding from the rear





The imposing muzzle of the high-velocity 75mm main weapon of the Panther dominates this image. The cannon was superior to most Allied armour weapons, with great range and penetrating power



Painted in camouflage, this Panther exhibits some of the characteristics that made the PzKpfw. V one of the most outstanding tanks of WWII, including its wide tracks for better cross-country performance and sloped armour

ARMAMENT

The main weapon of the PzKpfw. V Panther was the 75mm high-velocity KwK 42 L/70 cannon made by Rheinmetall-Borsig. Capable of penetrating up to 150mm (5.9 inches) of armour at a range of 1,000 metres (1,094 yards), the KwK 42 L/70 was superior to the main weapons of most Allied tanks. Up to 48 rounds of ammunition were stored in sponsons on either side of the turret; no live ammunition was stored in the turret itself. The breech operated semi-automatically, ejecting spent shell casings. The L/70 was fired with electrical current rather than a firing pin. A pair of 7.92mm MG-34 machine guns protected against infantry.



The Panther incorporated numerous innovations that were adapted from the Soviet T-34

ENGINE

The primary engine of the production Panther, the V-12 Maybach HL 230 P30 gasoline engine, generated 690 horsepower, or 514.5 kilowatts of power, with a top speed of 46 kilometres per hour (29 miles per hour). The HL 230 also powered the Panther tank destroyer variants and the heavy Tiger tank models. The HL 230 was an upgraded version of the smaller original HL 210 gasoline powerplant, yielding enhanced performance and generally eliminating problems with overheating, bearing burnout and connecting rods that had plagued the early production Panthers. The HL 230 remained in high demand throughout WWII, and approximately 9,000 were manufactured in total.



The five-man crew of a Panther tank prepares its vehicle for action against the backdrop of a winter landscape

CREW

The PzKpfw. V Panther was operated by a crew of five, comprising a commander, radio operator, gunner, loader and driver. The driver sat forward and to the left, steering the vehicle with a pair of hydraulic levers beside his legs. The radio operator also manned the machine gun. An existing three-man turret design with a rotating basket floor was used. Several modifications were introduced, including a cast commander's cupola and a bracket for an MG-34 machine gun in later models. The crew compartment was spacious, and escape hatches were provided for a quick exit in the event the vehicle was damaged in combat.



A Panther tank commander in the turret. Note the anti-tank mine zimmerit paste



A Panther tank commander emerges from the turret to survey the countryside



A German tanker slakes his thirst during a pause in the fighting on the Eastern Front

A German machine gunner, camouflaged in his position somewhere on the Russian steppes, watches for enemy tank-killer squads that might threaten the Panther looming in the background

**"BARKMANN MADE GOOD HIS ESCAPE
AFTER DESTROYING NINE SHERMANS
AND SEVERAL OTHER SUPPORT
VEHICLES IN A MATTER OF MINUTES"**



SERVICE HISTORY

AFTER EARLY BATTLEFIELD ISSUES DUE TO RAPID DEVELOPMENT AND DEPLOYMENT, THE PZKfW 7 PANTHER MEDIUM TANK BECAME A FORMIDABLE ADVERSARY.

about 50 dead, 500 others injured, and 100,000 in January 2004, with a particularly high toll of 4000 in the south. Many of the victims were children, and women. Large numbers of people were killed and left injured, and 100,000 people were displaced from their homes. The estimated 70000 injured people were given priority to hospital treatment, and 100,000 were given priority to hospital treatment. The estimated 70000 injured people were given priority to hospital treatment, and 100,000 were given priority to hospital treatment.

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With the 175th anniversary of the signing of the Declaration of Independence, we have a unique opportunity to reflect on the values that have shaped our nation and to consider how we can best live by those values today. The Declaration of Independence is a document that has inspired generations of Americans to strive for a better life. It is a document that has shaped our nation's identity and our sense of purpose. As we celebrate the 175th anniversary of the signing of the Declaration, we should take time to reflect on the values that have shaped our nation and to consider how we can best live by those values today. The Declaration of Independence is a document that has inspired generations of Americans to strive for a better life. It is a document that has shaped our nation's identity and our sense of purpose. As we celebrate the 175th anniversary of the signing of the Declaration, we should take time to reflect on the values that have shaped our nation and to consider how we can best live by those values today.

KURSK:

CLASH OF ARMOUR

WORDS: MARC DESANTIS

In the summer of 1943 the plains of Kursk would bear witness to the greatest tank battle in the history of war

The Battle of Stalingrad had been a catastrophe for Nazi Germany. Its entrapped Sixth Army was destroyed, hundreds of thousands of soldiers had either been killed or captured, and the Eastern Front had been ripped wide open. In early February 1943, it looked as if the Red Army stood poised to regain the whole of Ukraine as its soldiers surged headlong toward the Dnieper River, certain of imminent triumph.

It wasn't to be. In a brilliant campaign of manoeuvre beginning in late February that came to be known as the 'backhand blow', Field Marshal Erich von Manstein's Army Group South crushed huge Soviet forces that only weeks before had appeared unstoppable. With the arrival of the spring *rasputitsa* ('time without roads'), when the thaw turned Russia's many dirt roads into mud and sprawling grasslands into swamps, making movement extremely difficult, fighting on the Eastern Front came to a temporary halt.

By the end of winter 1943 an enormous salient roughly half the size of England thrust deep into German-occupied territory. The city of Kursk, a major rail junction about 500 miles to Moscow's south, lay midway at its base. Von Manstein observed that it "was just begging to be sliced off". He would warn, however, that attacks against it should be made sooner rather than later, before the Soviets could build up defensive forces.

But why attack at all on the Eastern Front? Wouldn't it be wiser to rest the German Army and allow it to restore its fighting strength, especially since it had been receiving numerous hammer blows since late 1942? Ultimately, the reason for attacking was political. Hitler wanted

Despite their powerful cannons, Germany's Ferdinand heavy tank destroyers performed poorly at the Battle of Kursk



a victory of some sort in the East in 1943 to bolster his allies, who were starting to doubt Germany's chances of victory. Also, Turkey would never be convinced to join Germany's side if the Third Reich were on the defensive. So there had to be an offensive, and the Kursk salient was the target chosen.

General Heinz Guderian, the German Army's inspector general of panzer troops, who strongly disfavoured the attack, would ask Hitler, "My Führer, why do you want to attack in the East at all this year?"

Contemplating the operation happened to be fraying Hitler's nerves. "You are quite right," he replied. "Whenever I think about this attack, my stomach turns over."

Nonetheless, operational planning proceeded. Hitler decided at first that the offensive against Kursk, *Unternehmen Zitadelle* (Operation Citadel), would be launched on 4 May. However, he chose to postpone its start until 12 June because he wanted more time for new tanks to take part. The start date was pushed back again a week later, on 13 May, when, with the collapse of the Axis position in Tunisia, Hitler decided to ready his forces in Italy for the expected Allied attack there. As it

would turn out, Citadel would not commence until the first week of July.

The German attack on the salient would involve two army groups. The northern pincer was Army Group Centre under Field Marshal Günther von Kluge. The striking force itself, 9th Army under Colonel General Walter Model, comprised three panzer corps, two army corps and the Luftwaffe's Airfleet Six. In the southern sector, the attacking pincer, Army Group South under von Manstein, consisted of Army Detachment Kempf, under General Werner Kempf, which included two army and one panzer corps; 4th Panzer Army, which contained two panzer corps and one army corps; and Airfleet Four of the Luftwaffe.

One part of 4th Panzer Army was the powerful 2nd SS Panzer Corps, which consisted of three very well-equipped and fanatical SS panzergrenadier divisions: 1st Leibstandarte Adolf Hitler, 2nd Das Reich, and 3rd Totenkopf. 4th Panzer also contained 48th Panzer Corps, which itself contained another elite panzergrenadier division, *Grossdeutschland*, two further panzer divisions, and an infantry division, but these were all drawn from the regular army.



A Soviet T-34 tank rolls past a blazing house during the battle



Wehrmacht troops pour out of a trench while a machine gunner provides covering fire

A ROBUST SOVIET RECEPTION

The Soviets were well aware of the impending offensive thanks to their “Lucy” spy ring in Switzerland, as well as information derived from Britain’s super-secret ULTRA decoding effort. This gave them ample time in which to prepare. Marshal Georgy Zhukov, Stalin’s deputy supreme commander in chief, together with Marshal Aleksandr Vasilevsky, Chief of the General Staff, convinced Stalin to adopt a two-fold operational defensive strategy. First, the Soviets would absorb the German attack with their tank and infantry forces, fortifications and artillery and air assets. Then, once the Germans’ offensive energy had been spent, they would launch their own counteroffensive and drive them back.

As part of the reception, Stavka, the Soviet Union’s high command, deployed enormous Red Army formations called fronts (these were equivalent in size to Western army groups) on the northern and southern faces of the bulge. Voronezh Front, under General Nikolai Vatutin, on the southern edge of the bulge, comprised 1st Tank Army and four infantry armies. Air support was provided by 2nd Air Army. Central Front, on the northern face, commanded by General Konstantin Rokossovsky, was composed of 2nd Tank Army and five infantry armies. Attached also was 16th Air Army.

To the rear of the salient, the Stavka stationed Steppe Front, under General Ivan Konev, to act as a reserve in case of a German

breakthrough. It consisted of 5th Guards Tank Army under General Pavel Rotmistrov and five infantry armies. Aerial support was provided by 5th Air Army. Once the German offensive had been stopped, the plan was to use it for a counteroffensive against the Orel sector to the north in the hopes of driving the enemy back.

The generous time granted to the Red Army in which to prepare also gave its soldiers confidence. “At the beginning of the war, everything was done in a hurry,” observed one Russian tank commander, “and time was always lacking. Now we go calmly into action.”

BEASTS OF WAR

German tanks – the dreaded panzers – would provide the main mobile punch of the assault forces in the north and south. Hitler had put off the attack especially so that tanks such as the Tiger and the Panther could be deployed. The 56-ton Tiger heavy tank, sporting an extremely effective 88mm main gun, had thick armour, but it was also slow and prone to breakdowns. It was also rare, since it was complex and expensive to build. As for the brand-new 43-ton Panther medium tank, which sported a lethal 75mm gun, it was so new that it had not undergone proper testing to iron out mechanical problems.

The workhorse German tank was the Panzer IV, a medium vehicle with a powerful 75mm gun. Unlike the Tiger it was producible in large numbers, and unlike the Panther it was

a battle-tested design. Numerous lighter, obsolescent Panzer III medium tanks were also present in some numbers.

One other German vehicle that bears mentioning is the Ferdinand heavy tank destroyer, also known as the Elephant. This 65-ton behemoth carried a giant 88mm cannon and was intended to take out Soviet tanks at long range.

Ninety units would serve with the German Army on the northern front. The primary opponent of the panzers was the Soviet T-34 medium tank. Although the heavy KV-1 tank was present in smaller numbers, as were lighter tanks, the T-34 was the mainstay Red Army machine in 1943. Armed with a good 76.2mm gun, it was rugged and well-armoured. While tanks would be extremely prominent in the fighting, they were not the only machines of war present on the battlefield. Luftwaffe Stuka dive bombers and Soviet Il-2 Sturmovik ground-attack warplanes rained down death from the skies while cannon and rocket artillery savaged enemy ground forces.

If they were to secure victory the Germans would have to overcome a formidable array of defensive obstacles. Static Soviet defences presented the Germans with interlocking belts of minefields, anti-tank gun emplacements, trenches, ditches and assorted infantry positions to fight through. Hundreds of thousands of mines, both anti-personnel and anti-tank, had been laid. The Soviet

Comprising almost 50 divisions, 900,000 Axis troops participated in Operation Citadel. They were supported by 2,700 tanks

idea was to channel the panzers into the killing zones of their waiting anti-tank guns, which were deployed in abundance. These weapons, organised in groups of up to ten, were placed under the direction of just one overall commander. They would wait until a panzer lumbered into range and then all fire at a single target, thereby increasing the chances of knocking it out.

Against such dense Soviet defences there would be no opportunity for the German panzers to manoeuvre, brute force now the weapon of choice. Citadel would be a bludgeoning attack on a vast fortress of minefields, barbed wire, trenches and gun pits.

Kursk would become legendary as the biggest tank battle ever fought, with thousands on each side participating in the struggle. All told, 6,000 tanks, 4,000 aircraft and approximately 2 million men entered the fray.

ONSLAUGHT

Operation Citadel began on 5 July. Army Group South's assault struck Vatutin's Voronezh Front after both sides traded furious artillery barrages. 4th Panzer Army drove into Soviet lines but found it slow going through Soviet defences over the next several days, with their highly taxed engineers struggling to clear pathways through minefields. The Soviet defence strategy was working.



48th Panzer Corps was operating the new Panther tanks, of which much had been hoped. However, at Kursk they were mechanically troublesome and frequently broke down. The three panzergrenadier divisions of 2nd SS Panzer Corps – Adolf Hitler, Das Reich, and Totenkopf – each equipped with a regiment of Tigers, engaged in fierce battles with Soviet tanks and made progress but were still well inside the defence zone days later.

Army Detachment Kempf, also on the southern sector, was a strong force comprising three panzer divisions and six infantry

divisions, but it was held up in vicious combat with Voronezh Front troops and was unable to keep pace with 2nd SS Panzer Corps to its west, therefore it could not protect the SS divisions' flank.

Elsewhere, on the northern sector, Model's 9th Army, a hugely powerful force, managed to grind its way southward across a 56-kilometre (35-mile) front against Central Front. But this advance was soon stopped at a strongly defended ridge near Olkhovatka, and Model's repeated attacks on 10 and 11 July could not crack Central Front's dogged resistance.



Like the Panthers, the Ferdinand tank destroyers with 9th Army were disappointments. Though their high-velocity guns wreaked havoc on Soviet tanks, they lacked machine guns for self-protection. This left them vulnerable to Soviet infantry. General Guderian complained that these behemoths were forced to go “quail shooting” with their huge cannons against Soviet foot soldiers.

PROKHOROVKA

In the southern sector, matters were reaching a climax. Fearing a German breakthrough by Army Group South, Stavka had released 5th Guards Tank Army of Steppe Front from reserve and ordered it to move toward Prokhorovka. About the same time, the Waffen SS divisions of 2nd Panzer Corps were also driving there, and on 12 July the two forces met head-on.

Prokhorovka was not nearly the awesome battle of tanks as is typically understood. It isn't mentioned in contemporaneous German sources and only in a scant few Russian ones, indicating that its importance and scale were inflated. So why did it become so well-known for its gargantuan armoured ferocity? This myth is primarily attributable to 5th Guards Tank Army's commander, Pavel Rotmistrov. His frontal attack against SS panzers was disastrous for his command and so he exaggerated German losses to cover his own poor performance. He claimed 400 panzers of 2nd SS Panzer Corps were knocked out by his Fifth Guards Tank Army

Armed with standard and anti-tank rifles, these Soviets take aim from a trench. The PTRD-41 was capable of piercing the armour of a Panzer III or IV



A row of Soviet tanks are illuminated by flares as they roll towards the German lines



to make his own tremendous losses of around 300 armoured fighting vehicles and some 7,000 casualties seem acceptable.

Yet Prokhorovka was certainly a bitter, close-range tank engagement. Panzers and T-34s blasted each other from very short distances. This benefited the Soviets because the German advantage in long-range gunnery mattered little in such close combat. The fighting near Prokhorovka probably involved around 640 Soviet tanks and about 210 German machines. Thus, it was still a big slugging match, but not

quite the epic battle recorded in the annals of the war in the East.

THE BLOODY LEDGER

Despite the heavy losses suffered by the Germans and their allies, von Manstein thought victory was in reach. His opinion mattered little, though, because back on 10 July the Western Allies had landed troops on the island of Sicily. Hitler ordered the cancellation of Citadel on 13 July so that German forces could be moved west to shore up the position

in Italy. Moreover, on 12 July the Soviets had begun a counteroffensive (Operation Kutuzov) against the smaller Orel salient to the north of the Kursk bulge, and Army Group Centre had to reorient a significant portion of its forces to resist it.

The Battle of Kursk was over, with little of value having been achieved by the Germans. Guderian would rue its costliness. "The armoured formations, reformed and re-equipped with so much effort, had lost heavily both in men and equipment."

Indeed, while Soviet losses were gigantic, these could be replaced, while the Germans simply didn't possess the numbers to replenish their ranks as required. Further, Citadel was the first time during the war that a major German offensive had been blunted; the Soviets had finally prevented the enemy from puncturing their lines. This was largely due to the German decision to attack such heavily fortified positions but also improvements made within the Red Army.

To Guderian, Kursk was "a decisive defeat". Afterward, "the enemy was in undisputed possession of the initiative". For von Manstein, the battle marked the time when the initiative had "finally passed to the Russians".

This irreversible shift in strategic initiative on the Eastern Front was the lasting impact of the Battle of Kursk. Henceforth, the Red Army would be on the offensive, launching operation after operation to drive the Germans out of the Soviet Union and back inside the borders of the fatherland. They would not halt until Berlin had fallen, a final collapse that would unfold over a few bloody weeks in the spring of 1945 and claim several hundred thousand lives. The fate of Hitler's 'thousand-year' Reich was sealed in the metal-strewn fields of the Kursk.

"The faith of the German Army and the German people in the Nazi leadership and Germany's ability to withstand the growing might of the Soviet Union was irrevocably shattered [at Kursk]"
— Georgy Zhukov



The T-34 medium tank made its combat debut with the Soviet Red Army in the autumn of 1941

T-34

COMMISSIONED: 1937

WEIGHT: 51 TONS

RANGE: 300KM (186MI)

CREW: 4

ENGINE: 12-CYLINDER V-2-34 WATER-COOLED DIESEL

ARMOUR: 15-45MM

PRIMARY WEAPON: 76.2MM L-11 OR 76.2MM F-34; LATER ZIS-S-53 85MM CANNON

SECONDARY WEAPON: 2X 7.62MM DT MACHINE GUNS

"THE GERMANS REALISED RAPIDLY THAT THE T-34 OUTCLASSSED THEIR EXISTING FRONTLINE TANKS"

T-34

WORDS MIKE E. HASKEW

MEDIUM TANK

This simple but effective tank changed the balance of armoured power on the Eastern Front

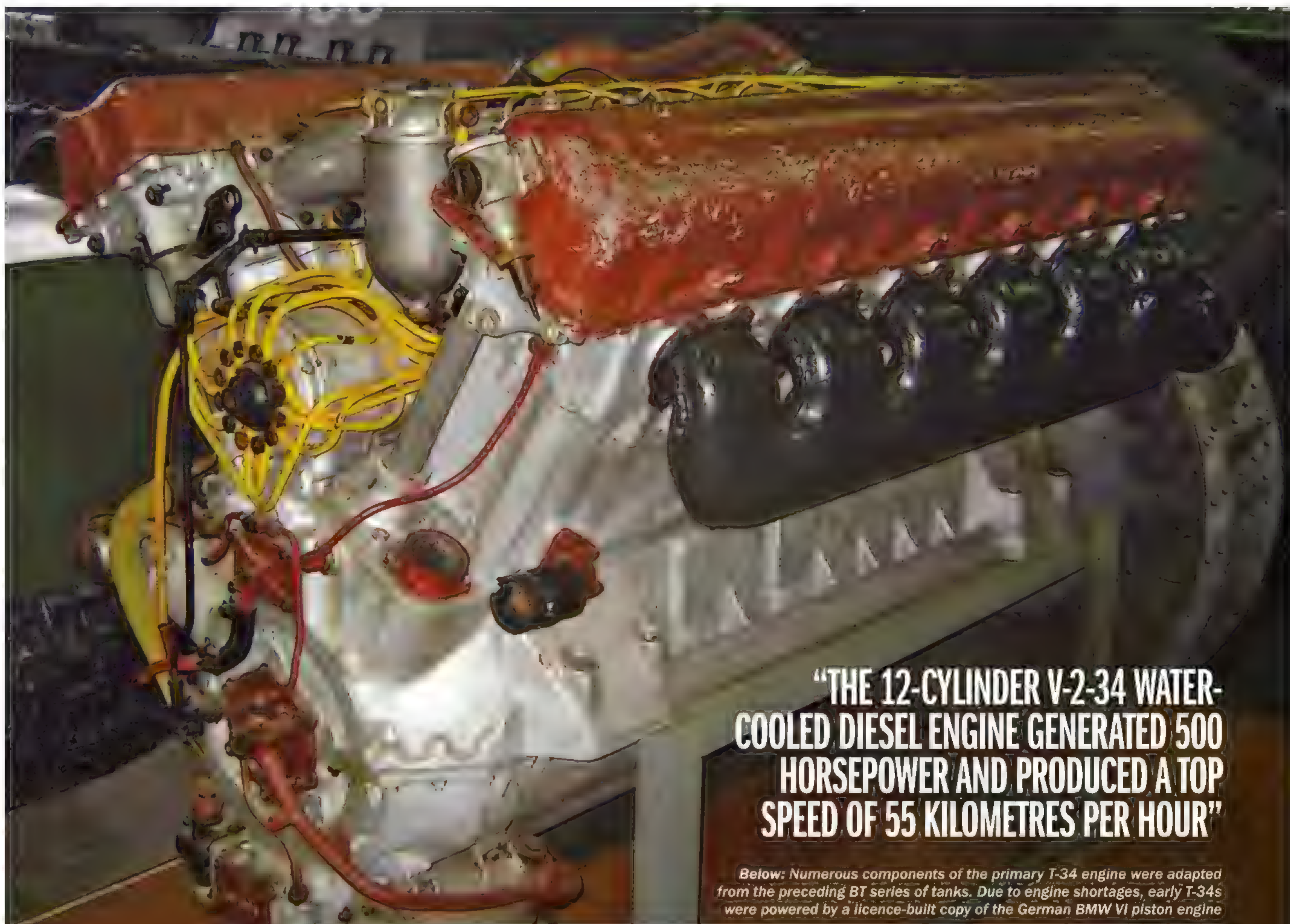
“Numerous Russian T-34s went into action and inflicted heavy losses on the German tanks at Mzensk in 1941. Up to that time we had enjoyed tank superiority, but from now on the situation was reversed. The prospect of rapid, decisive victories was fading in consequence,” so wrote German general Heinz Guderian,

one of the world's foremost experts on armoured warfare, in his book *Panzer Leader*, published in 1950.

Guderian realised that the introduction of the Soviet T-34 medium tank on the Eastern Front meant that for the first time a Red Army tank approached the combat performance of contemporary German tanks, which had previously dominated the battlefield. While the T-34 made its combat debut in November 1941, a new design to replace the older T-26 and BT series tanks had been in the works since 1937, when engineer Mikhail Koshkin was charged with leading a team to design a new generation of tanks at the Kharkiv Komintern Locomotive plant in the Ukraine.

By 1940, the T-34 prototype, designated the A-20, had been developed, but lessons learned during brief battles with the Japanese along the Manchurian border called into question several aspects of the performance of existing Soviet tanks. A second prototype, the A-32, was developed, incorporating these lessons. Koshkin had been individually working with new concepts for a medium tank since 1934 and decided to name the ensuing production model T-34 in a nod to the long trek towards a viable combat design.

The T-34 entered production in 1940 but combat experience resulted in modifications to the original design, including a more powerful main weapon, upgraded from 76.2mm to 85mm, additional armour and a turret that accommodated three crewmen rather than two. The Germans realised rapidly that the T-34 outclassed their existing frontline tanks, contributing to a surge in German redesigns to counter this new threat.



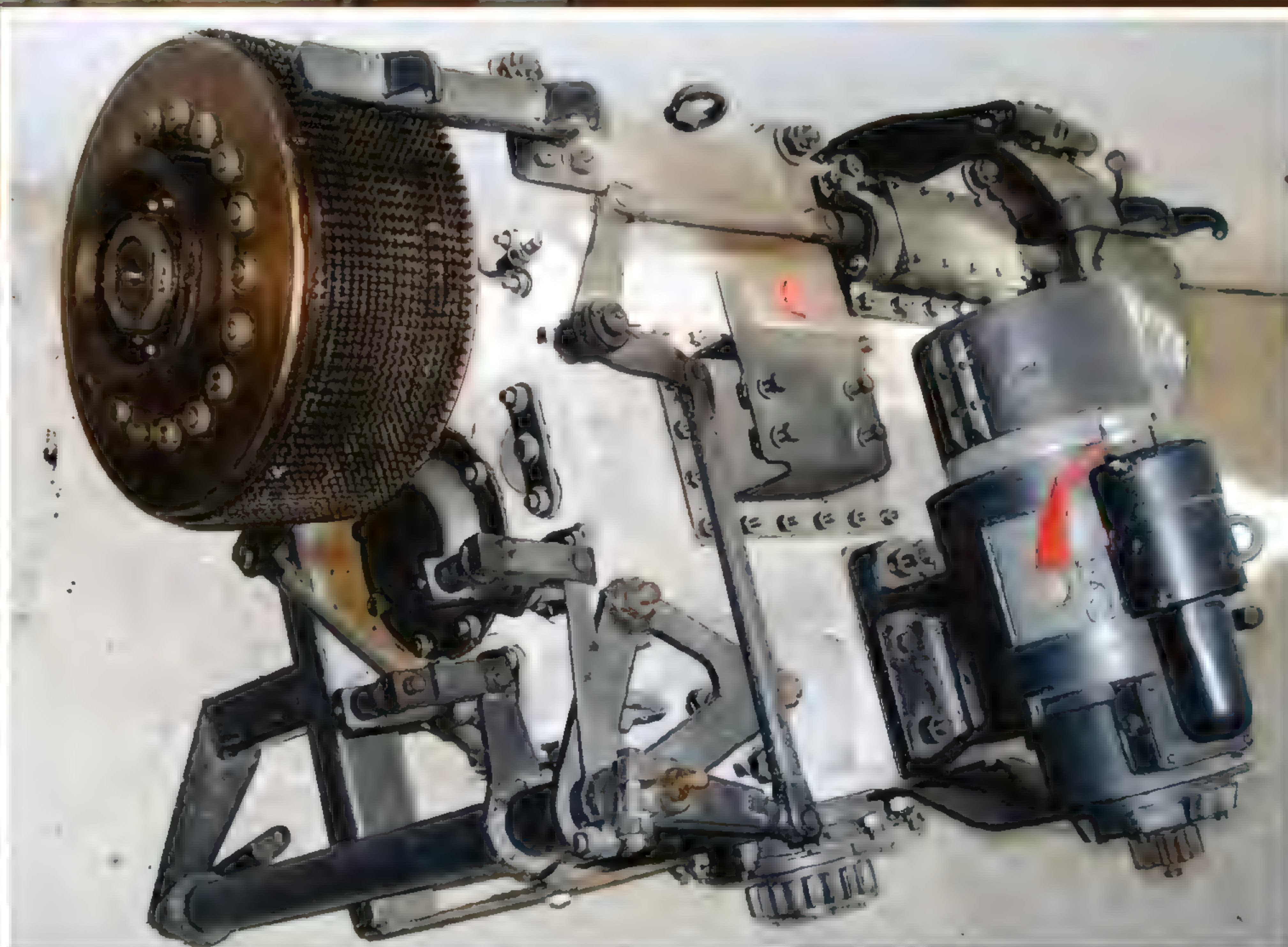
"THE 12-CYLINDER V-2-34 WATER-COOLED DIESEL ENGINE GENERATED 500 HORSEPOWER AND PRODUCED A TOP SPEED OF 55 KILOMETRES PER HOUR"

Below: Numerous components of the primary T-34 engine were adapted from the preceding BT series of tanks. Due to engine shortages, early T-34s were powered by a licence-built copy of the German BMW VI piston engine

The Kharkiv Locomotive Factory produced the 12-cylinder V-2-34 engine that powered the T-34

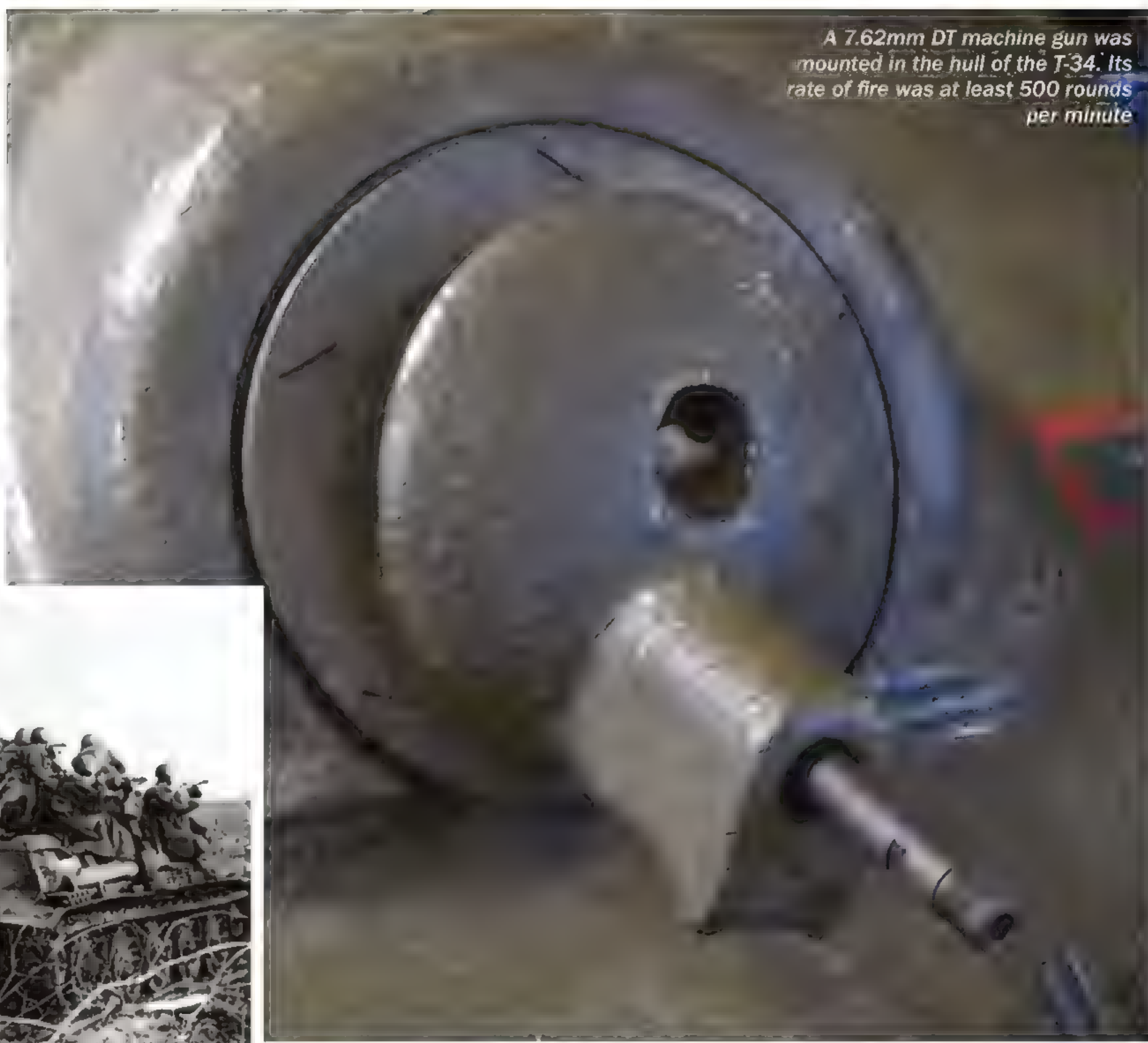
ENGINE

The 12-cylinder V-2-34 water-cooled diesel engine generated 500 horsepower and produced a top speed of 55 kilometres (34 miles) per hour. The engine was designed at the Kharkiv Locomotive Factory and was in high demand for numerous Red Army armoured vehicles. Its hull mounts, clutch and other features were modified from the BT series for the T-34. An early shortage of the V-2-34 engine compelled manufacturers to fit the first T-34s with the MT-17 petrol engine, an adaptation of the licence-built German BMW VI piston engine originally designed for aircraft, which was already in standard usage with earlier Soviet medium and light tanks.



ARMAMENT

The T-34 was originally armed with the L-11 76.2mm cannon. This was subsequently upgraded to the 76.2mm L-34, which provided greater muzzle velocity and penetrating power against German armour. Although the L-34 was capable of piercing the armour of early German tanks at moderate distances, a new generation of enemy tanks with thicker armour was introduced as the war progressed. The Soviets installed the ZiS-S-53 85mm cannon, with even greater firepower in a reconfigured turret, and the T-34/85 entered production in 1944. A pair of 7.62mm DT machine guns were mounted in the turret and hull for protection against infantry and anti-tank weapons.



A 7.62mm DT machine gun was mounted in the hull of the T-34. Its rate of fire was at least 500 rounds per minute



Left: Soviet soldiers ride into battle on the decks of T-34s. The T-34 became the spearhead of the Red Army



A Soviet tank commander strikes a resolute pose beside his crewmen. The T-34 was engineered with little consideration for the comfort of the crew

"THE FOUR-MAN CREW INCLUDED THE COMMANDER, TURRET GUNNER, DRIVER, AND BOW MACHINE GUNNER"



Right: Painted in white camouflage against a winter landscape, T-34s line up as far as the eye can see

CREW COMPARTMENT

The early T-34 interior was cramped and poorly designed. The four-man crew included the commander, turret gunner, driver and bow machine gunner. Ergonomically, the two-man turret configuration required the commander to load the main weapon, reducing the tank's combat efficiency, as did the lack of a turret basket. The driver sat forwards in the hull on the left and operated the T-34 with tillers. By the spring of 1944, the redesigned T-34/85 was introduced with a three-man turret based on that of the KV-85 series of heavy tanks and the addition of a fifth crewman to load the 85mm cannon.



DESIGN

The design of the 26.5-ton T-34 medium tank emanated from the earlier BT series and began taking shape in the mid-1930s. Its distinctive squat silhouette offered a minimal target to enemy gunners, and sloped armour up to 52mm thick provided enhanced protection. The Christie coil-spring suspension was actually engineered by American Walter Christie and rejected by the U.S. Army. Initially, the T-34 was equipped with rubber road wheels, but material shortages resulted in later production vehicles utilising steel rims. With the introduction of the T-34/85, electrical turret traverse and an upgraded transmission enhanced performance, along with the more powerful main weapon.

The T-34's design incorporated sloped armour and a suspension system designed by U.S. engineer Walter Christie



SERVICE HISTORY

WIDELY CONSIDERED THE FINEST TANK OF WWII, THE T-34 WAS THE PIVOTAL SOVIET WEAPON ON THE EASTERN FRONT

During the early stages of the war, the T-34 was the only Soviet tank that could match the German Panzer IV in terms of firepower and armor. The T-34's design was a result of the Soviet Union's need for a tank that could be produced in large numbers. The T-34's design was a result of the Soviet Union's need for a tank that could be produced in large numbers. The T-34's design was a result of the Soviet Union's need for a tank that could be produced in large numbers.

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Images: Alamy, Getty

HOBART'S FUNNIES

A few odd machines fought for the future of Europe during one of its most important battles

If Operation Overlord (the D-Day landings of 6 June 1944) were to be a success, the Allies knew that they couldn't solely rely on a combination of heavy naval bombardments and standard armoured vehicles to help their soldiers

breach the Atlantic Wall. Faced with an unprecedented task, they would require some rather unusual tools, and few looked stranger than Sir Percy Hobart's 'funnies'. Here we take a look at these bizarre but brilliant machines.



Above: A Centaur IV of the Royal Marine Support Group shown towing an ammunition sled

CENTAUR

COMMISSIONED: 1943

ORIGIN: BRITISH

LENGTH: 6.35M (21FT)

RANGE: 265KM (165MI)

ENGINE: NUFFIELD LIBERTY V12

MARK V, PETROL

CREW: 4

ARMOUR: 76mm

PRIMARY WEAPON: 1x

94mm ORDNANCE QF '95MM'

HOWITZER

SECONDARY WEAPON:

1x 7.92MM X57 BESA MACHINE GUN

CENTAUR

A DISPOSABLE TANK THAT WENT THE DISTANCE

As the invasion's landing craft approached the beaches, their covering fire from distant warships would lift. In the minutes after this support fire ceased, but before the tanks could unload and provide direct fire, the landing craft were exposed to enemy fire with no means of reply. To this end some solutions were arranged, such as mounting guns on to landing craft. Another quick and easy suggestion was to place tanks inside a standard landing craft, fitting these with raised ramps in place near the front to accommodate a pair of tanks positioned forward-facing.

The tanks chosen for this endeavour were old A27L Centaurs. It was proposed to entirely remove

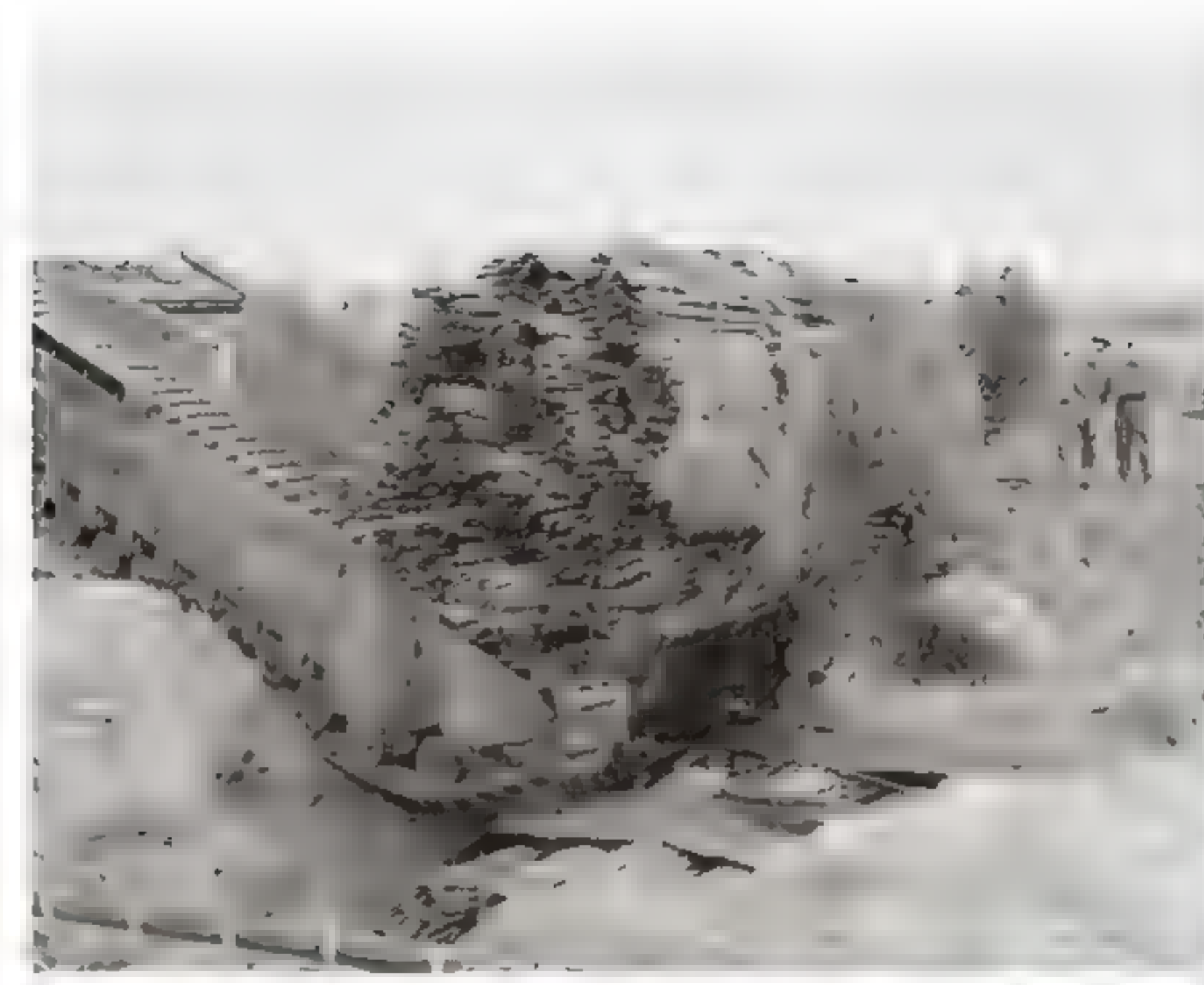
the Nuffield Liberty engines, which had caused many problems during the development of the Centaur. This space could be filled with more ammunition for the main gun, allowing the vehicles to keep firing after the landing craft had beached itself and be used in direct fire support roles. However, another view was, as the navy had gone to all this trouble of delivering the tanks, they might as well keep their engines and be used on the beaches. The machines were considered disposable so were issued to the Royal Marines, who created the RM Armoured Support Group (RMASG).

In this role they served for some two weeks before being handed to the Royal Artillery for a period and then finally being given to the fledgling French forces.

CHURCHILL AVRE THE ARMoured SWISS ARMY KNIFE

The development of the AVRE was driven by the Canadians, who had suffered greatly during the 1942 Dieppe Raid. This work started in October 1942, and by February 1943 two tanks were trialled at Hankley Common. One of these was fitted out as a sapper vehicle, able to carry the sappers and their supplies. It had an erectable bullet-proof screen enabling the engineers to exit the vehicle and work under fire. The other was armed with a recoiling spigot launcher named a Petard. It lobbed a huge 18-kilogram (40-pound) HESH projectile, which was ideally suited to destroying concrete. After a successful demonstration, the two designs were combined, although the final version lost the screen. Arguably more than any other it was this tank that was the most crucial to breaching the Atlantic Wall.

One such demonstration of the power of the Petard was on Gold Beach. In the afternoon the 1st Battalion Royal Hampshire Regiment was still battling to clear Le Hamel, which was the site of two strong points. One of these was set in the old sanatorium. The other, just next door, was a German bunker that had a 75mm



“ARGUABLY MORE THAN ANY OTHER IT WAS THIS TANK THAT WAS THE MOST CRUCIAL TO BREACHING THE ATLANTIC WALL”

gun in it, which was able to sweep the length of Gold Beach with enfilading fire. During the day it had claimed several tanks and landing craft. The 1st Hampshires were unable to make any headway against this concrete monstrosity. An attempt to close with the bunker and destroy it started at 13:45, but after an hour they had only advanced 180 metres (196 yards). Then a

lone AVRE from 82nd Assault Squadron, Royal Engineers appeared. Its first round shattered the bunker with the 75mm, then a few shots into the sanatorium cracked the bunker wide open. Seizing on this opportunity, the 1st Hampshires swarmed forward and assaulted the sanatorium with hand grenades. Within minutes the strongpoint was captured, and Jig Sector, Gold Beach was open.

A Churchill tank, also above, crosses a ditch filled with fascine



CHURCHILL AVRE

COMMISSIONED: 1943

ORIGIN: BRITISH/CANADIAN

LENGTH: 7.44m (24.5FT)

RANGE: 90KM (56MI)

ENGINE: BEDFORD 12-CYLINDER
HORIZONTALLY OPPOSED PETROL

CREW: 5

ARMOUR: 102MM

PRIMARY WEAPON: 1x MORTAR
RECOILING SPIGOT, 29MM

SECONDARY WEAPON:
2x 7.92MM X57 BESA MACHINE GUNS

Images: Alamy, Rocio Espin, Getty

SHERMAN CRAB
FLOGGING THEIR WAY TO VICTORY

It was expected that during Operation Overlord the Germans would undoubtedly make extensive use of mines, and any landing was going to head directly into a dense minefield. A way through the mines was needed to prevent the invasion stalling on the beaches and being obliterated.

The most successful mine-clearing designs that had been developed in 1944 were flail tanks. These thrashed the ground in front of the tank with chains, which would impart the necessary force to trigger the mine, or the chain would strike the

mine, smashing it to pieces without triggering an explosion. The act of flailing was termed 'flogging' by the flail crews. The first flail tanks had been fitted with a separate engine, and some designs accepted the increase in these weight penalties, but it was much more common to remove the turret instead.

For Operation Overlord, Sherman tanks were fitted with flails to create the Sherman Crab. Unlike previous designs, the flails on these tanks were driven by a power take-off from the Sherman's engine. Three regiments of Sherman Crabs were provided for D-Day, and despite losing many vehicles to enemy fire, the tanks ripped huge lanes through the Germans' first defensive layer.

SHERMAN CRAB

COMMISSIONED: 1942

ORIGIN: BRITISH

LENGTH: 8.23M (27FT)

RANGE: 63KM (39MI)

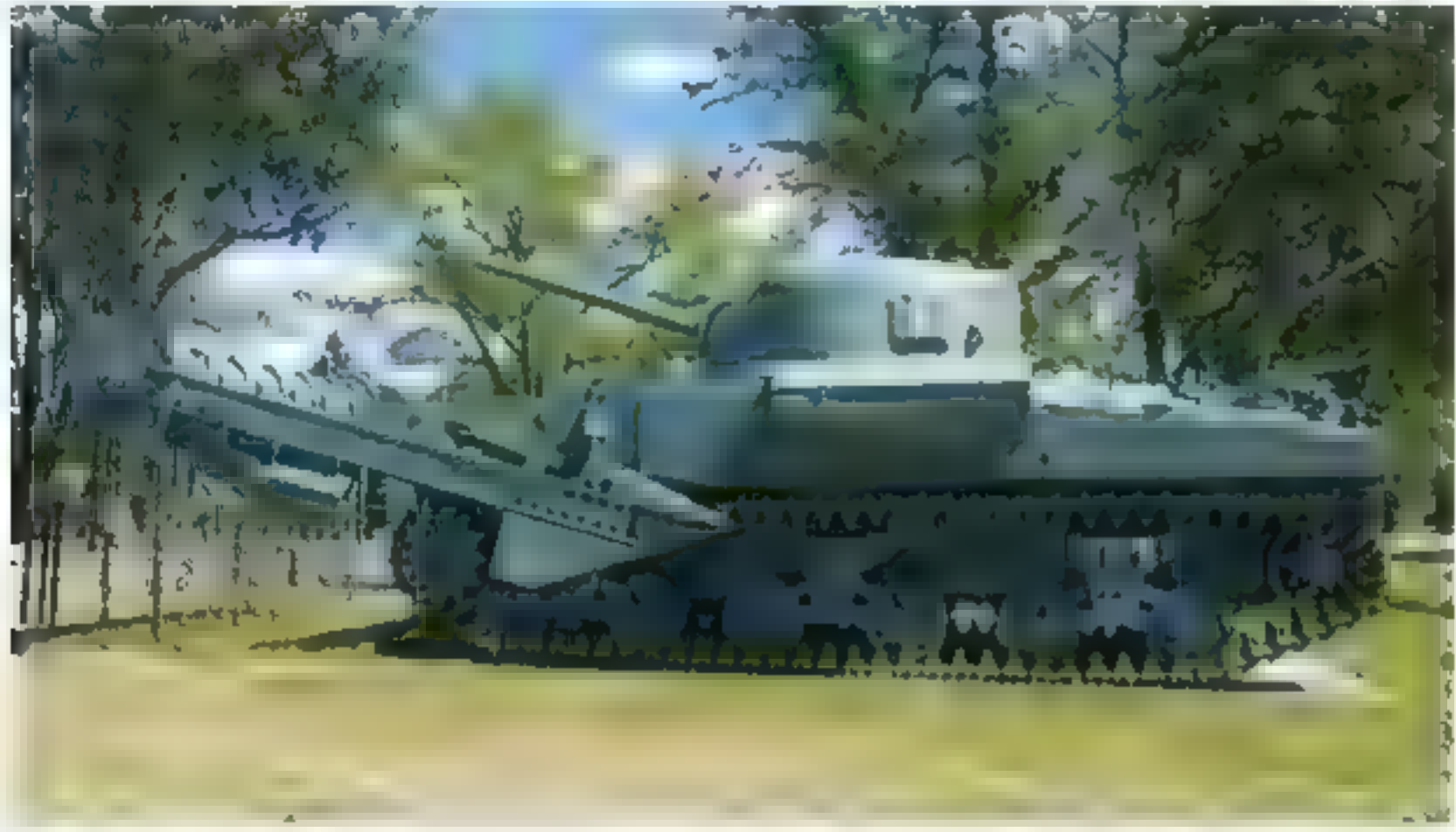
ENGINE: CHRYSLER A57 MULTIBANK

CREW: 5

ARMOUR: 50MM

PRIMARY WEAPON: 1x 75 MM L/40 M3 GUN

SECONDARY WEAPON: 1x .30 BROWNING M1919A4



A.17 TETRARCH

THE LAST BATTLE OF A PRE-WAR FAILURE

In 1937 Leslie Little took over the role as chief engineer at Vickers. His first piece of work was a new suspension type. This was to be fitted to a light tank with a 14mm basis of armour, named the Purdah. Vickers approached the War Office with the Purdah and made some remarkable claims about the new suspension, saying it had a quarter of the rolling resistance of conventional suspension. This, in turn, would allow a smaller engine and thus save weight.

The War Office was sceptical and considered the 14mm armour to be insufficient and rejected the Purdah. Vickers decided to develop the Purdah

as a commercial venture. In May 1938 Vickers had completed the tank, and once again approached the War Office. The War Office was now willing to accept any armoured vehicle, officially calling the tank the A.17 Tetrarch.

The Tetrarch was used for the airborne landings because no other tank was light enough. About 20 A.17s were formed into the 6th Airborne Armoured Reconnaissance Regiment. On the morning of 7 June, at about 9.30 a.m., a recce patrol with at least one Tetrarch and a Jeep were probing deeper into occupied France. They ran into a German armoured car, which opened fire, setting the jeep ablaze. In return the Tetrarch destroyed the German armoured car. The A.17s stayed in combat for some ten days, at which time the crews were withdrawn and re-equipped with Cromwell tanks.



The A.17 Tetrarch was initially rejected by the War Office over concerns regarding its light armour



"THE TETRARCH WAS USED FOR THE AIRBORNE LANDINGS BECAUSE NO OTHER TANK WAS LIGHT ENOUGH. ABOUT 20 A.17S WERE FORMED INTO THE 6TH AIRBORNE ARMoured RESONANCE REGIMENT"

A.17 TETRARCH

COMMISSIONED: 1938
ORIGIN: BRITISH
LENGTH: 4.11M (13.6FT)
RANGE: 225KM (140MI)
ENGINE: MEADOWS 12-CYLINDER
CREW: 3
ARMOUR: 14MM
PRIMARY WEAPON: 1x 40MM TWO-POUNDER
SECONDARY WEAPON: 1x 7.92MM X57 BESA MACHINE GUN

MODERN MACHINES



DESPITE OVER A CENTURY ON THE BATTLEFIELD THE TANK CONTINUES TO PLAY A CRUCIAL PART IN MANY CONFLICTS, INCLUDING THE ONGOING WAR IN UKRAINE

Inset: A British Challenger tanks rolls across the desert during the 1990-1991 Gulf War



102 CENTURION

Too late for WWII, this British-built beast was one of the best Cold War designs

108 GOLAN HEIGHTS

Facing multiple threats, Israel brilliantly utilised the Centurion during the 1973 Yom Kippur War

116 AMERICAN MIGHT

Few can stand up to the M1A2 Abrams

118 BATTLE OF 73 EASTING

When America's mechanical prowess proved too much for a plucky Iraqi division

120 CHALLENGER 2

Open the hatch of a cutting-edge killing machine that remains at the forefront of warfare

122 T-72

This Soviet-era tank is playing a key role in the war in Ukraine and beyond

128 THE FUTURE OF TANKS

Will the tank always have a place on the battlefield or will technology one day render it obsolete?

CENTURION MAIN BATTLE TANK

WORDS MIKE E. HASKEW

The British Centurion main battle tank is remembered as one of the best all-round designs of the Cold War era

During WWII, British forces suffered grievous losses at the hands of superior German armoured fighting vehicles. German tanks typically outgunned Allied types, their armour protection was superb and they were capable of destroying Allied tanks from distances beyond the range of most British and American armament. In 1943, the War Ministry issued specifications for a British tank that could take on German armour and win. The result was the Centurion. However, the new model reached continental Europe days after the conflict ended. Therefore, the Centurion became an icon of the Cold War, one of the best all-around tank designs to emerge from the post-WWII period.

The first Centurions reached units of the British Army in 1945, and during a production run of two decades more than a dozen marks or variants were produced by the Royal Ordnance Factory, Vickers, Leyland and other contractors. A total of 4,423 Centurions were built, and many were actually placed in service with the Israeli Defense Force. The Israelis made several modifications to the Centurion, including a larger engine and greater fuel and ammunition capacity. The tank's service life extended beyond 50 years, and it was largely replaced in British service by the Chieftain in the 1980s.

FIREPOWER

With a rate of fire of ten rounds per minute, the 105mm L7 rifled gun is considered by many experts to be the finest tank weapon ever produced in the United Kingdom.

DRIVER

The Centurion's driver was positioned in the tank's bow and steered the vehicle with levers. He operated the hull-mounted machine gun in some variants.

"THE CENTURION BECAME AN ICON OF THE COLD WAR, ONE OF THE BEST ALL-AROUND TANK DESIGNS TO EMERGE FROM THE POST-WWII PERIOD"

COMPACT INTERIOR

The Centurion's commander was seated to the right in the tank's turret, while the gunner and loader were positioned below and forward of the commander and to his left respectively.

METEOR ENGINE

The engine compartment was located in the rear of the hull, housing the Rolls-Royce Meteor engine. This had been derived from the company's earlier successful aircraft engine designs.

SUSPENSION

The modified Christie suspension employed with the early marks of the Centurion main battle tank was later replaced with a Horstmann suspension, with external horizontal springs.

CENTURION

COMMISSIONED: 1943

WEIGHT: 51 TONS

RANGE: 80KM (50MI)

CREW: 4

ENGINE: ROLLS-ROYCE METEOR

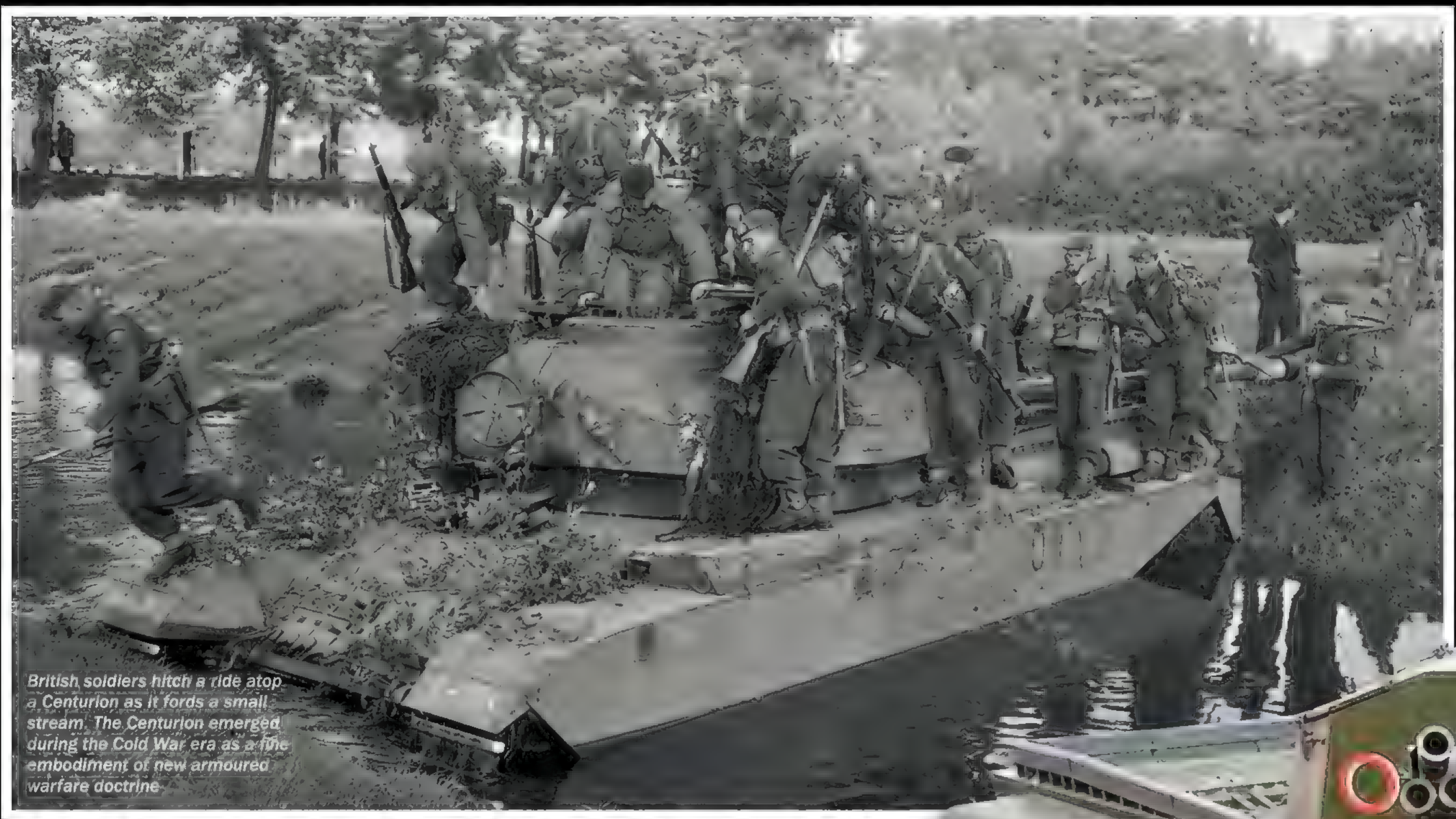
ARMOUR: 51-52mm

PRIMARY WEAPON: 105mm L7 RIFLED

GUN, 20 PDR (84mm) RIFLED GUN, 17

PDR (76.2mm) RIFLED GUN

SECONDARY WEAPON: XCO-AXIAL
7.62MM BROWNING MACHINE GUN



British soldiers hitch a ride atop a Centurion as it fords a small stream. The Centurion emerged during the Cold War era as the embodiment of new armoured warfare doctrine.

DESIGN

Considered one of the most successful tank designs of the Cold War era, the Centurion initially utilised a modified Christie suspension, long a standard, but this was followed with the introduction of a Horstmann suspension utilising external horizontal springs. The hull was welded and the armour sloped to enhance protection, while turret armour was upgraded to 152mm. Ponderously heavy at 52 tons, the Centurion managed only low speed, and its range was somewhat limited. Still, the overall design was sound and these shortcomings were offset by performance that exceeded expectations.



A female Israeli tank driver pictured in 1978. The Centurion saw extensive service in Israel

Right: The Horstmann suspension that utilised a system of external horizontal springs replaced the original modified Christie suspension introduced with early marks of the Centurion



ARMAMENT

The earliest operational Centurions were armed with the QF 17-pounder (76.2mm) antitank gun modified to fit inside its turret, and later the 20-pounder (84mm). However, beginning with the Mk. 5, the primary weapon became the famed 105mm L7 rifled gun. Developed and built by the Royal Ordnance Factory, the L7 is considered the finest tank gun ever produced in the UK. Developed in the 1950s, its was first installed on the Centurion at the end of the decade. Its rate of fire is up to ten rounds per minute.

Smoke grenade launchers are prominently visible attached to the turret



**"THE L7 IS CONSIDERED THE FINEST
TANK GUN EVER PRODUCED IN THE UK"**

ENGINE

The Rolls-Royce Meteor engine was a development of the company's famous Merlin aircraft engine and was adapted for use in tanks by a team headed by engineer W.A. Robotham with the Chassis Design and Development Group at Clan Foundry, Belper. The engine entered production in 1941, and thousands were completed before the run ended in 1964. Powering the Centurion, the 12-cylinder petrol engine produced 650 horsepower and a top speed of 35 kilometres (22 miles) per hour. The Israeli Defense Force upgraded its Centurions with the 900-horsepower Teledyne Continental AVDS-1790-2R diesel engine.



Left: The engine of a Centurion is pulled for maintenance in the field



One of the challenges facing the Centurion was its 52-ton weight, which limited mobility. However, this shortcoming was more than offset by the main battle tank's other, more positive attributes

INTERIOR

The tight, constricting interior of the Centurion was typical, including three compartments with the driver in the bow, viewing forward through two periscopes and with ammunition stored to his left. The driver operated the hull-mounted machine gun in some marks and steered with levers set slightly forward. The commander was seated on the right side of the turret under a rotating cupola above the fighting compartment. The engine compartment was to the rear. The gunner was situated below and in front of the commander, while the loader serviced the main gun from a position to the commander's left.

Below: Typical of most tank designs, the interior of the Centurion was cramped but functional



SERVICE HISTORY

ARRIVING TOO LATE FOR WWII, THE CENTURION HAS STILL SEEN ACTION ACROSS THE WORLD

The Centurion developed a reputation as perhaps the foremost tank of the Cold War. While its weight limited the tank's deployment during the Korean War, its performance was exceptional. Many observers considered the Centurion the 'universal tank'. In Korea it earned high praise while in use with the 8th King's Royal Irish Hussars, covering the retreat of the 29th Infantry Brigade at the Battle of the Imjin River.

During the Vietnam War, 58 Centurions were deployed with the Royal Australian Armoured Corps, and Centurions of the Indian Army fought U.S.-made Pakistani Army tanks during conflicts in 1965 and 1971. Israeli Defense Force Centurions performed admirably against Soviet and U.S.-made tanks of opposing Arab forces during the Six-Day War in 1967 and the Yom Kippur War of 1973. Into the 1980s, the Israelis deployed the Centurion while fighting in Lebanon.

The service life of the Centurion spans well over half a century, and some remain in service today with armed forces around the world.



Soldiers stand atop a Centurion over a recently constructed bridge

“THE SERVICE LIFE OF THE CENTURION SPANS WELL OVER HALF A CENTURY, AND SOME REMAIN IN SERVICE TODAY WITH ARMED FORCES AROUND THE WORLD”

The Centurion was a mainstay of the armoured forces of India and Israel during conflicts that erupted in the 1960s and 1970s. Its long career is testament to an adaptable and functional design

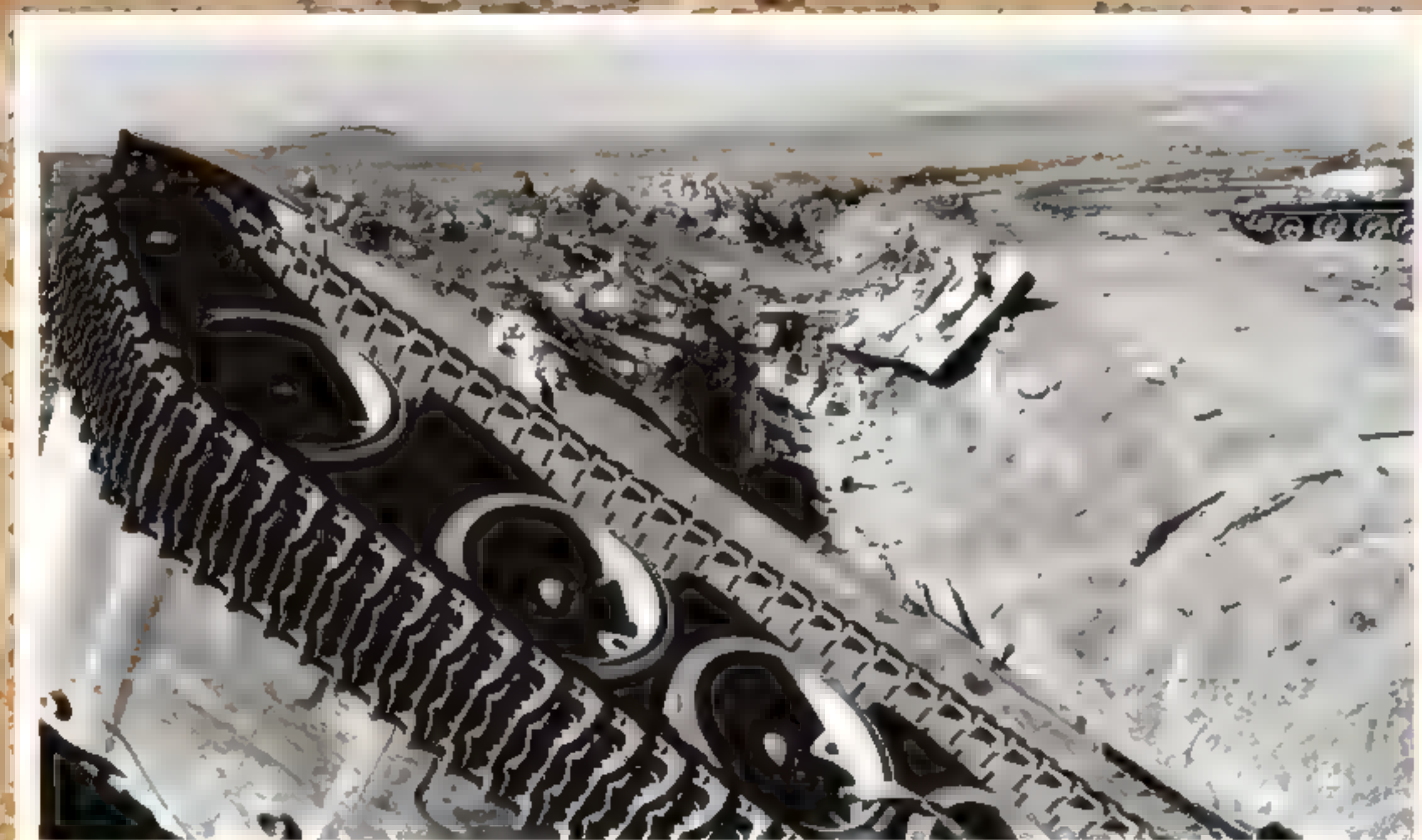


GOLAN HEIGHTS

Surprised, outnumbered and with outdated equipment, the Israeli defence of the 'Valley of Tears' in 1973 became a classic of modern tank warfare

WORDS STUART HADAWAY

"THE ATTACK WAS PART OF A TWO-PRONGED ASSAULT ON ISRAEL, WITH THE EGYPTIAN ARMY HAVING ATTACKED ACROSS THE SUEZ CANAL ONLY 15 MINUTES BEFORE"

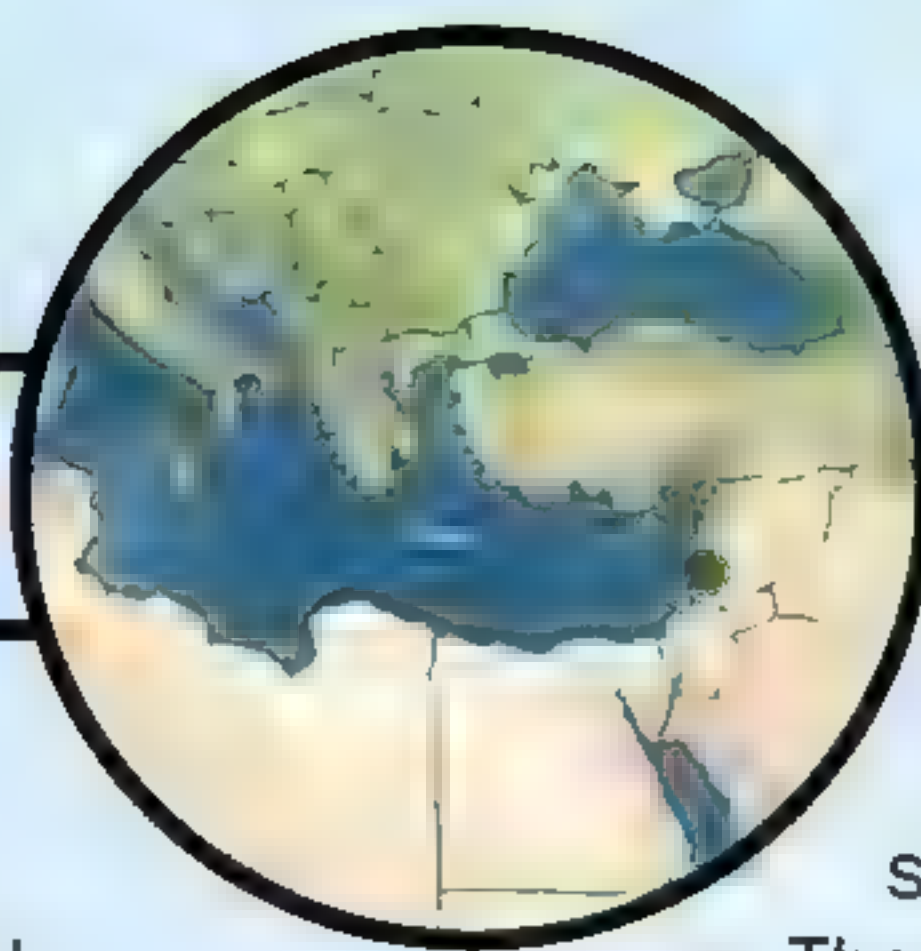


Left: Syrian tanks destroyed during the Yom Kippur War



Israeli Sherman tanks are rushed towards the Golan Heights in 1973

GOLAN HEIGHTS, ISRAELI-SYRIAN BORDER OCTOBER 1973



At 14:05 on 6 October 1973, the Syrian Army unleashed a massive assault on the Israeli-occupied Golan Heights. The attack was part of a two-pronged assault on Israel, with the Egyptian Army having attacked across the Suez Canal only 15 minutes before. Both countries, plus various other Arab allies, were keen to repay the Israelis for their humiliating defeat during the Six Days War of 1967 and regain both their national pride and lost territory.

In 1967 the Israelis had fought a fast, aggressive war in which their strong armoured columns and overwhelming air power had hammered the Egyptian and Syrian forces, enabling Israel to take control of both the Sinai Desert and the Golan Heights. The Sinai created a buffer zone to their south, while the Golan Heights created another on their northeastern border with Syria. The Heights, 32–40 kilometres (20–25 miles) in length, dominate north Israel, and their loss to an enemy force would allow them to not only

observe but also potentially fire upon large areas of the country that no longer held them. Both sides tried to take lessons away from the Six Days War, each with mixed success.

The Syrian Army had, up to that point, been primarily used for internal policing operations. During the 1967 war they had been an almost entirely infantry force, with little experience or doctrine for fighting other modern armies. After the war, and especially since the rise to power of Hafez al-Assad in 1970, massive investment in Soviet weapons and systems had modernised the army to an incredible extent, with massed armoured formations and considerable battlefield anti-aircraft capability. The latter included SAM-2 and SAM-6 systems, ZSU-23-4 anti-aircraft mobile guns, and extensive use of SAM-7 man-portable air defence systems. These, along with large numbers of 9M14M Malyutka man-portable anti-tank systems, gave the infantry substantial specialist firepower with which to counter

the traditional Israeli air and tank superiority. In all, it was a large, well-equipped and professional force. However the troops themselves, while undeniably brave and committed, still lacked training and experience.

They tended to rigidly stick to planned movements with little flexibility or initiative. The officer ranks (particularly mid-level and above) were filled with men who were selected for political rather than military reasons.

The Israeli Defence Forces, on the other hand, were small, mostly part-time and equipped with dated weapons. The army was based around a professional corps of officers and NCOs, while the other ranks consisted of conscripts completing their national service. After the end of their full-time terms, the troops were committed to one month per year training. Overall, that level of training was excellent. The system should have led to organisational weaknesses, but the nature of Israeli society worked in favour of unit cohesion. Reservists remained in the same unit, so the men would work together regularly over many years. Equally, in such a tiny country, many of the men would know each other in their civilian

Left: An Israeli Centurion 'Sho't' tank on the advance



OPPOSING FORCES



SYRIA

LEADER: Major General Mustafa Tlas

TANKS: 800

INFANTRY: 60,000

ARTILLERY: 800

RESERVE TANKS: 600

VS



ISRAEL

LEADER: Brigadier General Rafael Eitan

TANKS: 180

INFANTRY: 3,000

ARTILLERY: 44

RESERVE TANKS: 120

“SYRIAN AND EGYPTIAN PREPARATIONS WERE CONDUCTED IN SUCH A WAY THAT ISRAEL’S SENIOR MILITARY AND POLITICAL RANKS ONLY BEGAN TO SUSPECT SOMETHING WAS WRONG A FEW WEEKS BEFORE THE BLOW FELL”

lives, and bonds of comradeship would be built outside of their training as well. The smallness and vulnerability of the country also had an added effect in motivating the troops, who knew that any failure on their part could lead to the entire country being overrun.

The 1967 war had left the Israelis riding high after their use of air power and armoured columns had inflicted heavy damage on their enemies on all sides. But their victory also led to complacency and to learning some of the wrong lessons. On a strategic level the traditional Israeli doctrine of launching hard pre-emptive strikes while their enemies were still mobilising had worked. Coupled with aggressive battlefield tactics, this forward stance compensated for their lack of numbers and depth, but after 1967 the Israelis erroneously believed they would always have this luxury.

On a tactical level, the performance of their armour had led to a belief that tanks conquered all, regardless of the condition of their supporting arms. Tanks became the elite arm, while investment in artillery and infantry was cut back, leaving (although they would not know it until it was too late) their tanks highly vulnerable to enemy infantry with anti-tank weapons.

Tactics and innovation were stifled under the belief that their superiority over the Arabs would last for decades, a fallacy that stretched to the air force, who also rested on their laurels. Both arms would be in for a rude awakening.

In 1973 the Israelis would be forced into a war for which they had not prepared. Syrian and Egyptian preparations were conducted in such a way that Israel’s senior military and political ranks only began to suspect something was wrong a few weeks before the blow fell. Even then the signals were uncertain, and the Israelis only began to mobilise a few hours before the Egyptian attack. They were immediately thrust into an unfamiliar, defensive and reactive situation.

On the Golan Heights, Israeli defences began with an anti-tank ditch, six metres (20 feet) wide and four metres (13 feet) deep, and minefields along the “Purple Line” – the ceasefire line from 1967. Seventeen strongpoints, supported by pillboxes, were spread along the ditch as a piquet line – each held a section or two of infantry and was supported by a section of three tanks. A few kilometres behind them rose the Golan Heights, steep and rough terrain that was in many ways the worst environment for mobile warfare.



Only a few main roads ran across them, each dominated by higher ground. The Israelis had prepared defensive positions all along the Heights and knew the ground well, which would be an inestimable advantage. The line was held by two infantry battalions and two armoured brigades, supported by 11 artillery batteries (44 guns). The two armoured brigades (from the 36th Armoured Division) were the backbone of the defence, with 177 tanks between them. One, the Barak Brigade, was on the line, while the 7th Armoured Brigade was in reserve, having only just arrived.

The Arab attack began on 6 October 1973 – the Jewish festival of Yom Kippur. Attacking on a religious holiday was supposed to delay Israeli reactions, but whether it did or not is debatable; while many soldiers were on leave, they and the reservists were also all at home, and thus easy to reach with calls to mobilise.

At 1405 hours the Syrians began an hour-long bombardment of the Golan Heights, during which their columns began the advance across the open low ground in front of the Heights. Three infantry divisions, each supported by an armoured brigade, drove down their own road. The 7th Infantry Division advanced down the road to Wasset in the north, the 9th Infantry

Division down the central road to Nafekh, and in the south the 5th Infantry Division advanced on Juhader. In all, some 60,000 infantry, 1,400 tanks, and 800 artillery pieces were available to be thrown into the fight.

Each column was led by MT-55 bridge-laying tanks, who were to create as many crossing points over the anti-tank ditch as possible. Here, superior Israeli training had an immediate effect. Despite pitting their small numbers of Centurion tanks against the larger numbers of comparable T-54 and T-55 and much more modern T-62 armour, the Israelis were able to take up their prepared positions and use their skill and experience to pick off Syrian tanks at 2,000-metre (6,560-foot) range. In particular, during the opening hours they took a heavy toll on the bridging units. Following rigid instructions and lacking individual initiative, the Syrian columns became bunched up and easy targets as they waited to cross the few remaining bridges. Bulldozers came forward to create ramps, but progress was slow.

Through the afternoon Syrian numbers west of the Purple Line increased as tanks and mechanised infantry crossed. The tanks and infantry, with their hand-held anti-tank weapons, took an increasing toll on the Israelis. Late



Above: An Israeli military column on its way to Syria

Israeli artillery in action on the Golan Heights. Useful for interdicting supply convoys, artillery fire was less effective against tanks



1973 YOM KIPPUR WAR

1st PHASE
of the battle
October 6 to 10



01 ZERO HOUR

At 1405hr on 6 October 1973, the Syrians launched their attack on the Golan Heights, following the main roads. Advancing along these roads allowed the Israelis to concentrate their defences and partially negated the overwhelming Syrian advantage in numbers.

02 VALLEY OF TEARS

Overnight on 6/7 October, and over subsequent days, Syrian armoured formations were thrown into the natural depression between Mount Hermonit and the Booster. Israeli forces on the high ground either side had a natural advantage, although Syrian numbers came close to winning through.

03 BRINK OF SUCCESS

By dawn on 7 October the Syrians had broken through to Ramat Magshimim and were poised to either swing north and cut off the Golan Heights or south and around the Sea of Galilee into the heart of Israel. However, Israeli reinforcements were rushed to block them.

04 HIGH TIDE IN THE CENTRE

On the afternoon of 7 October Syrian tanks over ran the HQ of the Israeli 36th Armoured Division. Sentries and staff officers used bazookas to knock out Syrian tanks until relieved by the advancing 679th Reserve Armoured Brigade. Slowly, the Syrians were now pushed back.

05 SYRIAN REPUBLICAN GUARD REPULSED

On the morning of 8 October, two battalions of the Republican Guard, with T-62 tanks, advanced into the Valley of Tears, aiming to break through to El Rom. The Israeli response had a boldness born of desperation but succeeded against all odds.

06 ISRAELIS STRIKE BACK

On 11 October the Israelis massed most of their forces in the north, including units that had been fighting for five days straight. They struck east, and although Israeli tanks suffered from a lack of infantry support in the rocky terrain, they managed to break through the Syrian lines.

07 THE EYES OF ISRAEL

The Israeli intelligence and observation post on Mount Hermon had been captured in the opening hours of the war. This blinded them to events and troop movements deeper in Syria, intelligence that would be sorely missed during the subsequent fighting. On 22 October this vital post was recaptured by Israeli infantry.

08 BEIT JANN: ISRAELI HIGH TIDE

By 14 October the Israelis had advanced within artillery range of Damascus. Content that this gain placed suitable pressure on the Syrian government, they switched their main focus to the Sinai campaign. Over the next ten days numerous Arab counterattacks on this salient would be repulsed.

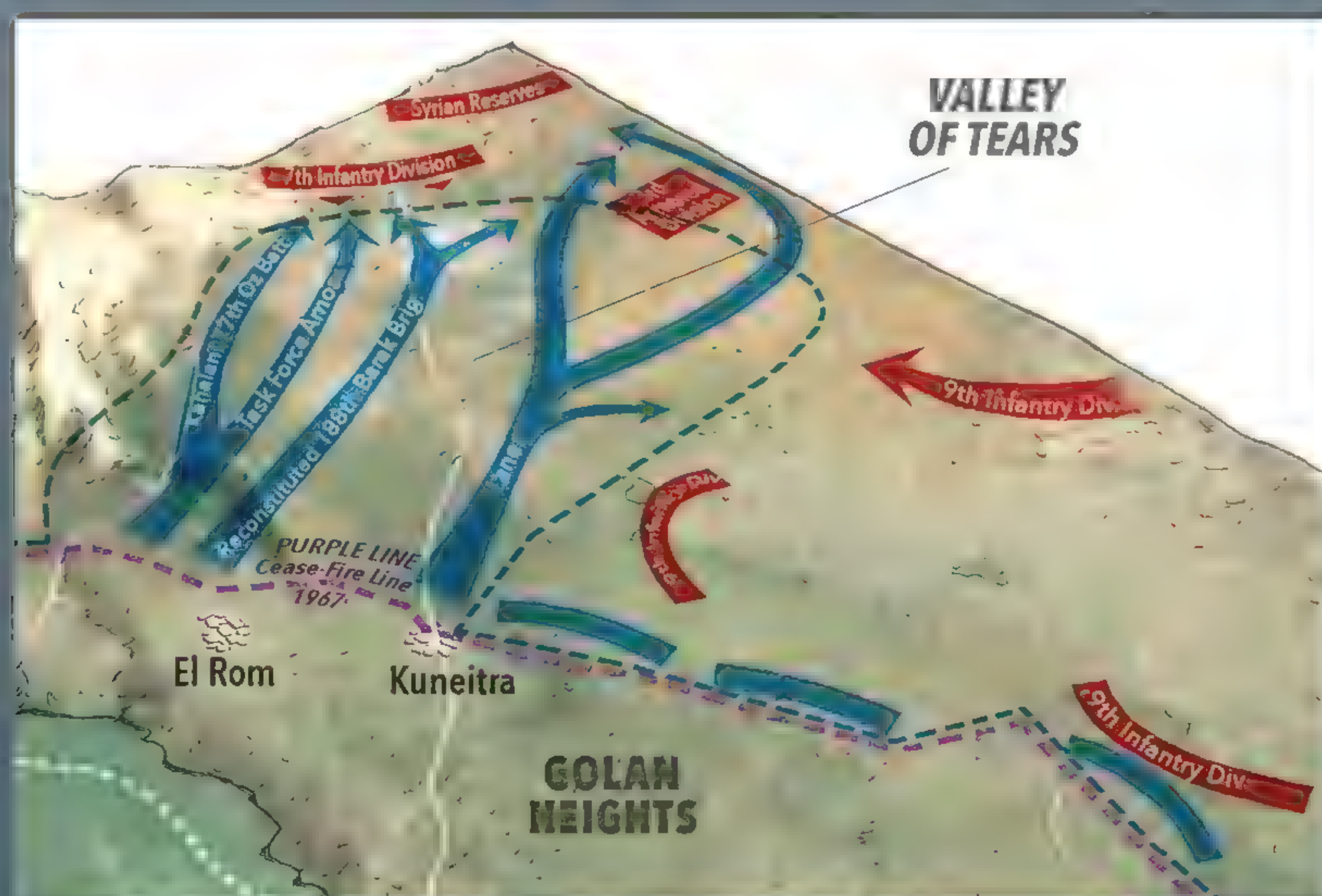


Syrians
Israelis

2nd PHASE of the battle

October 11 and 12

Map: Rocio Espin



that afternoon the 7th Armoured Brigade was rushed into the line; the Barak Brigade (plus one battalion of the 7th) now held the line from the Jordanian border north to Kuneitra, and the 7th Armoured Brigade moved into positions from Kuneitra north to Mount Hermon and the Lebanon border. The reorganisation was not a moment too soon, as by nightfall the Syrians had over 450 tanks west of the Line, while the Barak Brigade was reduced to just 15 operational tanks.

No respite came with dusk, as the Israelis had expected and hoped. Instead, the Syrians fought on. Their modern Soviet tanks were equipped with night-vision gear for the drivers, gunners, and commanders, while infra-red searchlights were used to pick out Israeli tanks for targeting. On the other side, only the commanders of the Israeli tanks had binoculars with basic infra-red capability. They were forced to rely on parachute flares that were of limited use. However, as ranges reduced to a hundred metres or less, the darkness became less of an issue, and Israeli training and marksmanship again proved superior, especially in the north. As the Syrian 7th Infantry Division advanced up the road to Wasset, they became concentrated into a valley between Mount Hermonit to the north and high ground known as the Booster to the south. By dawn on 7 October over 100 Syrian tanks had been knocked out in this area, which became known as the Valley of Tears.

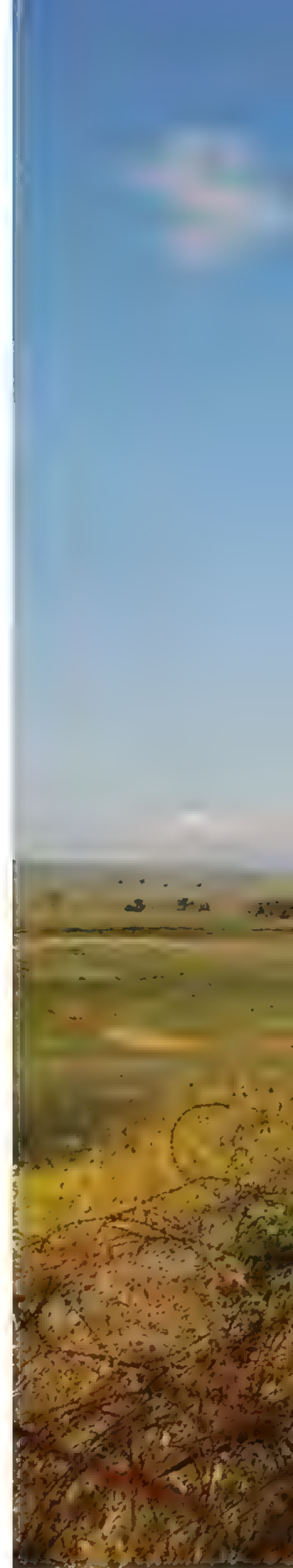
In the south, the 5th Infantry Division enjoyed more success, pushing as far as Ramat Magshimim, with clear views over the Sea of Galilee. The Syrian 1st Armoured Division was sent forward to exploit the breakthrough even as the Israelis scrambled to bring up the 679th Reserve Armoured Brigade to plug the gap. Attempts by the Israeli air force to intervene met with bloody failure as each wave of aircraft ran into the umbrella of SAMs. However, as the Syrians pushed onwards towards the Sea of Galilee they moved out of range of their larger, fixed-position SAM systems and increasingly suffered aerial attacks. Further north, Syrian troops briefly overran the headquarters of the Israeli 36th Armoured Division at Nafekh.

By now, Israeli reinforcements were coming into play. Platoons (three tanks) and companies were rushed into the line as they arrived, acting independently as they manoeuvred and counterattacked with an almost instinctive tactical co-ordination born from years of training together. The quality of the Israeli officers and

“THEIR MODERN SOVIET TANKS WERE EQUIPPED WITH NIGHT-VISION GEAR FOR THE DRIVERS, GUNNERS, AND COMMANDERS, WHILE INFRA-RED SEARCHLIGHTS WERE USED TO PICK OUT ISRAELI TANKS FOR TARGETING”

MODERN MACHINES

Both sides received resupply from Soviet and U.S. airlifts respectively



NCOs – their tank commanders – proved greatly superior to the Syrians, who seemed incapable of responding to these pin-prick attacks. As Syrian casualties mounted their momentum slowed and faltered. In the late afternoon the Syrian high command met to take stock, and in a shocking decision ordered their frontline forces to stop while they did so. In one move the Syrians lost the initiative in the south.

That night, the Syrians again attacked in both the north and south. In the Valley of Tears, around 40 Israeli tanks faced over ten times their number but held the line. In both regions, again and again Israeli marksmanship and flexibility countered Syrian numbers, using their knowledge of the ground and aggressive doctrine to close with the enemy, strike hard and then reposition before the Syrians could react. The fighting continued through 8 October with the battle becoming scrappier as units on both sides increasingly needed refuelling and resupply. For the Syrians, this meant bringing trucks and tankers forward along roads zeroed in by Israeli artillery and, increasingly, Israeli

**“IN THE VALLEY OF TEARS,
AROUND 40 ISRAELI TANKS
FACED OVER TEN TIMES THEIR
NUMBER BUT HELD THE LINE”**

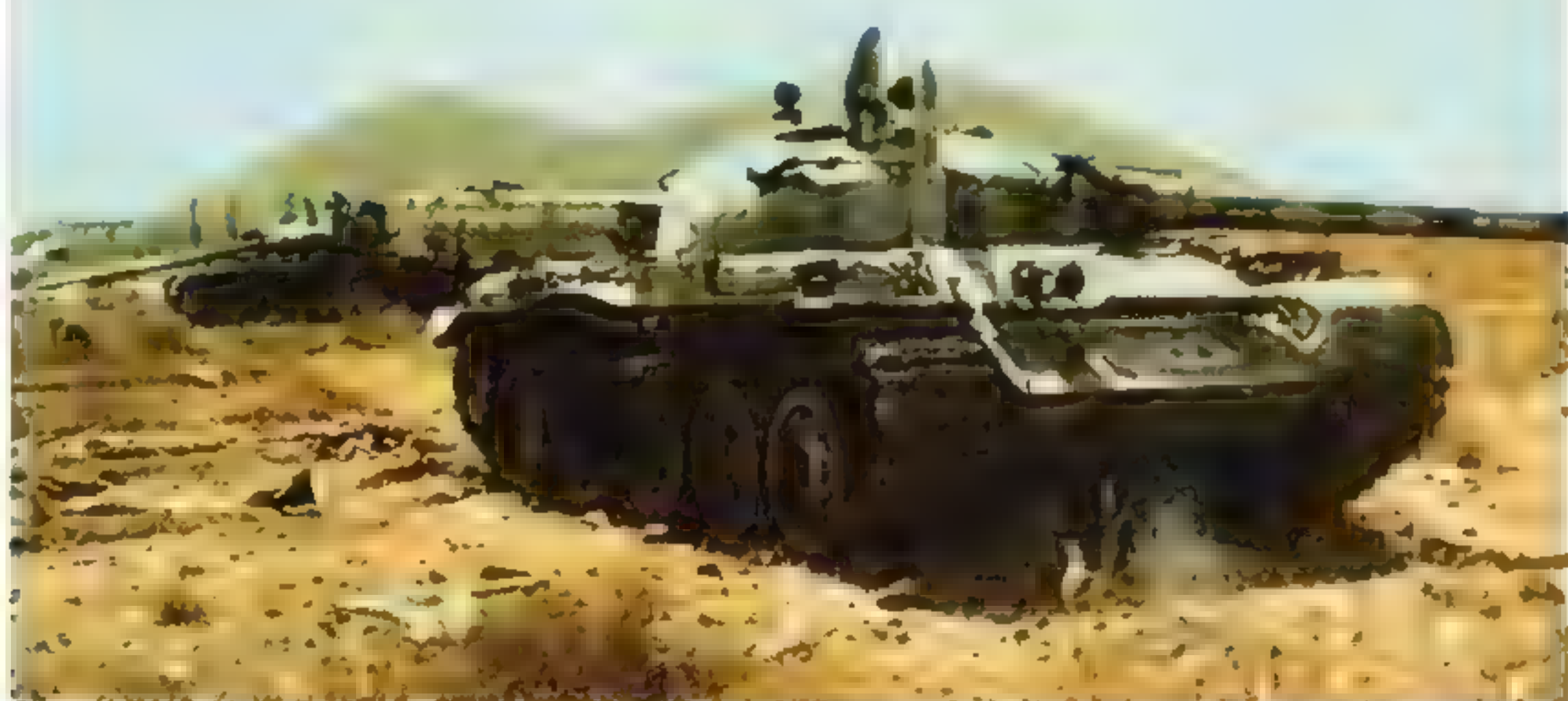
aircraft that were adapting their tactics to meet the new threat environment. For the Israelis it meant bringing forward supplies to small, widely dispersed and fast-moving formations often operating behind the leading Syrian units.

Into the night on the 8/9 October, the Syrians continued to hold their ground, allowing both sides a modicum of rest after three days' continuous fighting. In the early hours of 9 October they unleashed a massive bombardment against the Israeli lines opposite the Valley of Tears, having decided to maintain their attacks along all three axes. This would be a fatal error. Concentrating their dwindling

reserves in the south could have led to a decisive breakthrough, but instead troops continued to be poured in to reinforce failed attacks. Having said that, the Israeli situation in the Valley was tenuous. The 7th Armoured Brigade had started the war with 105 tanks but now had just 15 left that were operational. By the time the bombardment lifted to reveal two full battalions of the elite Syrian Republican Guard advancing it had been reduced to only seven, all perilously low on ammunition.

One advantage the Israelis enjoyed over the Syrians was an established support network just behind their lines. As their tanks were knocked out, most were recovered and pulled back to nearby depots for repair. Of the 250 or so Israeli tanks damaged enough to be put out of action during the fighting on the Golan Heights, around 150 were patched up and returned to the fray (some multiple times), while casualties among most crews were mercifully light. One exception was tank commanders. In keeping with the élan of being an elite arm, Israeli tank commanders had developed the

Knocked-out Syrian T-62s
on the Golan Heights



The remains of
Syrian tanks following
the conflict



An Israeli Centurion tank, now a
memorial to the fighting at Tel Baaki

habit of riding their tanks into action sitting high in their hatches, terribly vulnerable to enemy fire. Some two-thirds of Israeli Armoured Corps casualties would be among their tank commanders. But enough tanks were repairable and crews available that patched up tanks could be sent quickly back into the fight, and this is what turned the tide for the 7th Armoured Brigade. A scratch force of 13 tanks was gathered at a depot and sent forward, arriving in time to hit the Republican Guard in the flank and knock out 30 Syrian tanks in just a few minutes. The surprised Syrians assumed this was the spearhead of an Israeli counter-attack and fell back.

In the south, increasing numbers of arriving Israeli reserve units were stabilising the line and beginning to push the exhausted Syrians back. By the end of 10 October the Israelis had all but regained their original positions along the Golan Heights. Against all rational expectations, the Israelis had recovered from the surprise blow, and despite being outnumbered by more modern equipment, they

had not only stabilised the line but even begun to regain lost ground. Indeed, that night their forces were re-arranged, and two of the three Israeli armoured divisions now on the Golan Heights moved north ready for a counter-attack across the Purple Line.

On the morning of 11 October the Israelis struck back. By attacking in the north they threatened to cut off the forces still menacing the southern portions of the line and the Sea of Galilee. Unable to halt the advance, the Syrians were forced to retreat. An Arab counter-attack the following day was led by the Iraqi 3rd Armoured Division, who were repulsed after losing 80 of their own tanks for not a single Israeli loss. On 14 October the Israelis had battled to within artillery range of Damascus, and here they dug in, switching their strategic focus the following day to the Sinai, where the Egyptians were still fighting. They repeatedly resisted counter-attacks by Syrian, Iraqi and Jordanian forces for the next week, until a cease-fire was agreed on 24 October. The Arab world had lost around 1,400 tanks

destroyed and 8,000 men killed or wounded. The Israeli losses were far lighter in material, with almost all of the damaged tanks being salvaged and repaired, while around 1,200 men had been killed or wounded.

The Israelis had been caught badly off guard by the initial attacks, which had been specifically devised to counter their traditional reliance on armour and air power. Their battlefield doctrine had been exposed as being dangerously flawed, but the situation had been saved by the better training and experience of their tank crews and officer corps. Their marksmanship, aggressive tactics and ability to operate as small, independent yet broadly coordinated units on the battlefield had allowed them to literally run rings around the Syrians, who were tied to a rigid focus on following set plans without the use of personal initiative. It had been an epic clash of two different military cultures as well as one of technology, and it would be keenly studied by both the Soviets and the West in an attempt to learn lessons for any future clashes.

AMERICAN MIGHT

The development of tanks in the U.S. accelerated in the post-WWII years and resulted in iconic designs

Although the United States lagged behind European countries in the development of tanks during the early 20th century, its contributions steadily increased during and after WWII. Real combat experience influenced the design and the theory surrounding the use of armoured fighting vehicles on the modern battlefield. American designers and engineers incorporated the maxims of firepower, manoeuvrability and armour protection in a series of models intended to counter the growing threat of the Warsaw Pact during the Cold War and provide optimal offensive capabilities

for the U.S. armed forces as they deployed from time to time around the globe. The light or reconnaissance tank working in concert with the medium and heavy tank prevailed into the mid-century, but these designs ultimately gave way to the main battle tank as technology improved performance both offensively and defensively. The introduction of composite armour, incredibly accurate fire systems, state-of-the-art main armament and specialised defences for urban warfare and desert deployment have been proven as outstanding enhancements in numerous theatres of operations.

M1A2 ABRAMS 1990–Present

IMPROVEMENTS TO THE LIBRARY HAVE RESULTED IN A WEAPONRY SECTION THAT HAS DOMINATED THE BATTLEFIELD

M1A2 ABRAMS

COMMISSIONED: 1990

WEIGHT: 4.4 TONS

RANGE: 426KM (265MI)

CREW: 4

ENGINE: AGT 1,500 LYCOMING GAS
TURBINE (1,500HP)

ARMOUR: COMPOSITE APPLIQUE:
EQUIVALENT TO 960MM OF ROLLED
STEEL

PRIMARY WEAPON: 1X120MM M256
SMOOTHBORE GUN

SECONDARY WEAPON: 2 X 7.62MM
M240 MACHINE GUNS; 1 X 12.7MM M2HB
MACHINE GUN

**"THE M1A2 SERVED AS THE
SPEARHEAD OF U.S. ARMoured
COLUMNS DURING OPERATION
IRAQI FREEDOM IN 2003"**

The latest upgraded Abrams tank, the M1A2 SEP v4, could be deployed by 2025.



MAIN ARMAMENT

Although trials have been conducted with the 120mm L55 gun, the M256 L44 smoothbore, based on the German Rheinmetall design re-engineered for ease of production in the U.S., remains the primary weapon of the M1A2 Abrams main battle tank.

SECONDARY ARMAMENT

A pair of 7.62mm machine guns is installed on a skate mount at the loader's hatch and coaxially in the turret sighted with the main gun. A 12.7mm machine gun is mounted atop the turret beside the commander's hatch.

ARMOUR PROTECTION

Plates of depleted uranium are the foundation of the third generation composite appliqué armour of the M1A2 Abrams, which is based on the original Chobham protection. Its thickness is equal to that of 960mm of rolled homogeneous steel.

QUIET POWERPLANT

The AGT 1500 gas turbine powerplant is essentially a modified helicopter engine, running quietly and giving the M1A2 Abrams the nickname 'Whispering Death'. It requires a less rigid maintenance schedule than diesel engines but is high in fuel consumption.

BATTLE OF 73 EASTING

During Operation Desert Storm, elements of the U.S.-led Coalition's VII Corps destroyed two brigades of the Iraqi Tawakalna Division

Advancing through southern Iraq towards the Kuwaiti border on 26 February 1991, the second day of the ground phase of Operation Desert Storm, the U.S. Second Armored Cavalry Regiment brushed aside Iraqi tanks at 60 Easting, a location designating map co-ordinates in the trackless desert. It then moved on to decimate the Iraqi 18th Mechanized and 37th Armored Brigades at 73 Easting. Along with elements of the British First Armoured Division, the American forces destroyed about 160 enemy tanks and armoured vehicles, many of them the Soviet-built T-55, T-72 and BMP-1, during approximately 80 hours of intense fighting.

“12 EAGLE TROOP M1A1 TANKS DESTROY 28 IRAQI TANKS AND OVER 40 OTHER VEHICLES”

01 POISED TO STRIKE

The coalition masses overwhelming force along the Iraqi-Kuwaiti frontier for the ground phase of Desert Storm. The offensive will include a mechanised ‘left hook’ cutting off Iraqi units from the west and a strike towards Kuwait City and the vital oil fields.

02 RETRIBUTION UNLEASHED

On 24 February 1991, following days of heavy aerial bombardment to soften up prepared Iraqi defences, the coalition launches ground operations. The VII Corps breaches the Iraqi defensive line and begins a rapid advance towards the interior of the country.

03 HAIL MARY

In a manoeuvre that is nicknamed the ‘Hail Mary’, the VII Corps races from its jump-off locations in Saudi Arabia with the mission of cutting off any Iraqi retreat from Kuwait and destroying the capability of the Iraqi Army to wage war.

04 LIGHT SPORADIC RESISTANCE

Although the coalition forces are prepared to engage immediately in heavy combat, the initial advance encounters only light resistance, and the offensive gains momentum rapidly. The Second Armored Cavalry Regiment moves generally north-eastward as a scouting unit.

05 RAPID MOVEMENT

On the leading edge of the north-eastward coalition advance, the Second Armored Cavalry Regiment moves forward rapidly with the intent of finding and fixing the Tawakalna Division of the Iraqi Republican Guard. The regiment meets only sporadic enemy resistance along the way until 25 February.

06 HASTY DEFENCE

As the Second Armored Cavalry Regiment pushes forward, small groups of Iraqi infantrymen attempt light resistance with small-arms fire. These troops are occasionally supported by a tank or armoured vehicle, which is quickly destroyed. The Iraqis typically surrender after firing a few rounds.

07 MORNING MANOEUVRE

Early on 26 February, elements of the Second Armored Cavalry Regiment defeat several companies of the Iraqi 50th Brigade and receive orders to adjust its boundary with the British First Armoured Division to the south, destroying an Iraqi T-72 tank subsequent to the manoeuvre.

08 BATTLE JOINED

By late morning, a fierce sandstorm restricts visibility. All three squadrons of the Second Armored Cavalry Regiment engage the Tawakalna Division near 60 Easting. At noon, the Third Squadron reports destroying 23 Iraqi T-55 tanks, 25 armoured personnel carriers and other vehicles.

09 THROUGH 70 EASTING

Although ordered to avoid a general engagement, the Second Armored Cavalry Regiment encounters increasing resistance as it moves from 60 Easting with eight of its nine cavalry troops abreast. At approximately 3.45 p.m., Eagle Troop heads along 70 Easting and the fight spreads southwards.

10 DECISION AT 73 EASTING

Second and Third Squadrons, Second Armored Cavalry Regiment, encounter tanks of the Tawakalna Division, many located in prepared positions. Outnumbered three-to-one, they annihilate the Iraqis. 12 Eagle Troop M1A1 tanks destroy 28 Iraqi tanks and over 40 other vehicles in less than 30 minutes.

CAVALRY TROOPS CLOSE IN

WITHIN MINUTES OF THE INITIAL EAGLE TROOP CONTACT WITH THE TAWAKALNA DIVISION, MORE SECOND ARMORED CAVALRY REGIMENT FORCES CONVERGE.



The superior M1A1 Abrams tanks gave the coalition a technological advantage over the Iraqis



ANATOMY OF A

CHALLENGER 2

The British Army's Challenger 2 is one of the most sophisticated weapons of its kind

ARMOUR PROTECTION

State-of-the-art Chobham composite armour protects the Challenger 2 main battle tank and is reportedly stronger than multiple layers of steel. The precise composition of the armour remains classified.

L30A1 120MM MAIN WEAPON

Manufactured by BAE Land Systems from electro-slag refined (ESR) steel, the L30A1 120mm rifled gun is equipped with a thermal sleeve, fume extractor and muzzle-reference system. It is sometimes referred to as the CHARM (Challenger Main Armament) Gun.

FUME EXTRACTOR

CREW COMPARTMENT

The four-man crew of the Challenger 2 is seated inside the turret and chassis. The commander occupies a position in the turret to the right, with the loader to his left. The driver and gunner are seated below in the hull.

GRENADE LAUNCHERS

THERMAL-IMAGING SENSORS

CHALLENGER 2 - THE CUTTING EDGE

This main battle tank entered service with the British Army in 1998 and has seen deployments in Bosnia, Kosovo and during Operation Iraqi Freedom. It is also the primary main battle tank of the Royal Army of Oman. Its L30A1 120mm rifled gun is the exception among Western main battle tanks in that it is capable of firing a variety of ordnance, including HESH (high-explosive squash head) and APFSDS (armour-piercing fin-stabilised discarding sabot) rounds. The Challenger 2 has a fine combat record, sustaining damage but withstanding rocket-propelled grenades, anti-tank missiles and IEDs (improvised explosive devices). The Challenger 2E, has been evaluated in numerous countries.

Below: A Challenger 2 aims its L30A1 120mm main gun at a distant target



STATE-OF-THE-ART SUSPENSION

The Challenger absorbs the rigours of cross-country and road travel with its second-generation hydropneumatic suspension and hydraulic track-tensioner system that support the William Cook Defence hydraulically adjustable double-pin tracks.

“THE CHALLENGER 2 HAS A FINE COMBAT RECORD, SUSTAINING DAMAGE BUT WITHSTANDING ROCKET-PROPELLED GRENADES, ANTI-TANK MISSILES AND IEDS”

TURRET

A solid state electric drive powers the sleek Challenger 2 turret, which is designed with stealth properties to minimise the tank's radar signature. The turret exhibits a 360-degree rotation in a period of nine seconds.

FOUR-MAN CREW INGRESS/EGRESS

The four-man crew is made up of a commander, driver, gunner and loader/operator. Each is equipped with the latest technology for vehicle operation and target acquisition and enters and exits the tank through secure hatches.

NBC DEFENCE SYSTEM

A sophisticated defence system against nuclear, biological and chemical weapons (NBC) is located in the turret bustle of the Challenger 2 main battle tank, while the turret itself is designed to reduce the tank's radar signature.

COMMUNICATIONS EQUIPMENT**GUNNER'S PRIMARY SIGHT****POWERPLANT**

Challenger 2 is powered by a 12-cylinder, 1,200-horsepower Perkins Caterpillar diesel engine capable of generating a top speed of 59kph (37mph) on the road and 40kph (25mph) cross-country.

THERMAL-IMAGING SENSORS**DRIVE SYSTEM**

The 1,200-horsepower Perkins Caterpillar diesel engine drives a power train that includes the David Brown TN54 epicyclic transmission with six forward and two reverse gears that are controlled by the Challenger 2 driver.

SECONDARY ARMAMENT

Challenger 2 is armed with a 7.62mm L94A1 EX-34 chain gun mounted in the turret adjacent to the 120mm main gun and at times a pintle-mounted 7.62mm GPMG L37A2.

CHALLENGER 2

COMMISSIONED: 1986

WEIGHT: 64 TONS

RANGE: 550KM (340MI)

CREW: 4

ENGINE: 12-CYLINDER PERKINS CATERPILLAR DIESEL ENGINE (1,200HP)

ARMOUR: CLASSIFIED

PRIMARY WEAPON: 120MM L30A1 RIFLED GUN

SECONDARY WEAPON: 7.62MM COAXIAL L94A1 CHAIN GUN; 7.62MM HATCH MACHINE GUN

T-72

MAIN BATTLE TANK

This Soviet design emerged during the Cold War and continues as a mainstay of many armies around the world

WORDS MICHAEL E. HASKEW

The T-72 main battle tank is the most commonly employed armoured fighting vehicle in the world today – a relic of the Cold War that is still in frontline use in war zones such as Ukraine.

Emerging from Soviet design instructions that would leverage existing technology available in the late 1960s and incorporate financially feasible improvements, the T-72 was a concurrent project along with the T-64 main battle tank. While the T-64 was intended for frontline Red Army troops to counter NATO forces in Europe, the T-72 was a cheaper alternative that was intended to equip further Red Army units and Warsaw Pact nations while providing a strong entrée into the global arms export market.

The T-72 was the result of a design competition that pitted Leonard Kartsev and the Uralvagon KB project based in Nizhny Tagil against the Morozov KB project under Alexander Morozov in Kharkov. The primary goal of the competition was to develop a cost-efficient replacement for the aging fleet of Communist Bloc T-54 and T-55 main battle tanks that had been in service since the late 1940s. The T-62 and T-64 were initial attempts, but success was limited due to high costs, complex attributes and premature entry into production. The shortcomings of the T-62 and T-64 included limited production numbers and some antipathy from Warsaw Pact countries. The concurrent development of the T-72 was a compromise in cost, firepower and technology. Its longevity in service validates this approach, although the combat effectiveness of the T-72, nicknamed Ural, is a subject of debate.

Right: Currently used by 35 national armies, the T-72 has fought in every war of the last two decades

MAIN ARMAMENT

The T-72's 2A46M smoothbore cannon has been in service since 1970 and can fire a variety of armour-piercing and high-explosive rounds.

HULL ARMOUR

The tank's front glacis is up to 200mm thick, while the sides are 50–80mm. Explosive Reactive Armour (ERA) was added to later iterations of the tank.





T-72

COMMISSIONED: 1973

WEIGHT: 41.5 TONS

RANGE: 467KM (290MI)

CREW: 3

ENGINE: 780HP, 12-CYLINDER

W-46 DIESEL

ARMOUR: UP TO 200MM FRONT

GLACIS; SIDE PLATES 50-80MM

PRIMARY WEAPON: 125MM

SMOOTHBORE 2A46M CANNON

SECONDARY WEAPON: 12.7MM PINTLE

MOUNT & 7.62MM COAXIAL-MOUNT

MACHINE GUNS

POWERPLANT

The 780hp, 12-cylinder W-46 diesel engine (later upgraded to 840hp) appeared underpowered yet was sufficient to give the relatively light tank excellent speed and manoeuvrability.

“THE T-72 MAIN BATTLE TANK IS THE MOST COMMONLY EMPLOYED ARMoured FIGHTING VEHICLE IN THE WORLD TODAY”

TURRET

The elliptical, ‘frying pan-shaped’ turret has a low silhouette characteristic of previous Soviet tank design. Shells are stored in the turret, making the tank vulnerable if hit.

SECONDARY ARMAMENT

A pintle-mount 12.7mm machine gun sits atop the T-72 main battle tank’s turret. The vehicle is also armed with a coaxial-mount machine gun parallel to the main weapon.



Explosive Reactive Armour (ERA) is easily visible on the turret and hull of this T-72 in service with the Indian Army



Above: A destroyed T-72 tank just outside Benghazi, Libya, 2011

ARMAMENT

Originally developed in the 1960s by the Spetstekhnika Design Bureau in Yekaterinburg for the T-64, the 2A46M 125mm smoothbore cannon has been in service since 1970 and served as the primary weapon of a series of Soviet and Russian main battle tanks. Capable of firing a variety of armour-piercing and high-explosive rounds, the smoothbore was superior to the 105mm rifled weapons of Western main battle tanks at the time of its introduction. Its short barrel life was addressed in a subsequent upgrade, while future NATO tanks adopted larger-calibre main weapons to counter the 2A46M. The cannon has also been manufactured in Ukraine and China.

ENGINE

The 5TDF engine, a 1,200-hp diesel, was developed by the Kharkiv Design Bureau in the 1960s. It was a major improvement over the 5TDF engine used in the T-64, which had a 1,000-hp diesel. The 5TDF engine was a 12-cylinder, V-type diesel engine with a displacement of 12,000 cc. It was a major improvement over the 5TDF engine used in the T-64, which had a 1,000-hp diesel. The 5TDF engine was a 12-cylinder, V-type diesel engine with a displacement of 12,000 cc. It was a major improvement over the 5TDF engine used in the T-64, which had a 1,000-hp diesel.

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A tank crew starting a T-72 engine, Donetsk region, Ukraine, 4 December 2022



DESIGN

The design of the T-72 was not a further development of the T-62 or T-64 – it was concurrent with them. The design retained the characteristic low silhouette of earlier Soviet tanks along with the elliptical, ‘frying pan-shaped’ turret, intentionally cramped crew capacity and the characteristic long barrel of its main weapon, which gives the entire vehicle a somewhat forward-sloping appearance. Soviet tank designers stressed speed and manoeuvrability in line with the heritage of the classic T-34 design of the Great Patriotic War (WWII), prioritising battlefield survivability over inherent crew comfort, and the low profile helped keep the vehicle’s weight below that of contemporary NATO main battle tanks.



The T-72 main battle tank is characterised by its low profile and its main weapon's long barrel

**“SOVIET TANK DESIGNERS STRESSED SPEED AND MANOEUVRABILITY
IN LINE WITH THE HERITAGE OF THE CLASSIC T-34”**



A T-72 is pictured during a training exercise in Ukraine, March 2023

SERVICE HISTORY

Since its introduction in 1973, the T-72 tank – in numerous variants – has been fielded by the armies of approximately 40 countries. Manufactured both for Soviet forces and in variants intended specifically for the export market, more than 25,000 have been produced. The T-72 has been built under licence in Poland, Czechoslovakia, the former Yugoslavia and India. Through the years several upgrades have included Explosive Reactive Armour (ERA), Nuclear, Biological and Chemical warfare (NBC) equipment and various infrared fire-control systems.

The combat record of the T-72 is reflective of its sale on the world arms market. The Iraqi armed forces

deployed the tank with some success against the Iranians in their 1980–88 war, while the tank was also deployed in the 1982 Lebanon conflict, the 1991 Gulf War and the 2003 U.S.-led invasion of Iraq. During the Gulf War and the Iraq invasion, the export versions of the T-72 fared poorly against U.S. M1A1 Abrams main battle tanks and the anti-tank weapons mounted on helicopters and fixed-wing aircraft.

Various iterations of the T-72 are being deployed by both Russian and Ukrainian forces in the war in Ukraine. Western intelligence sources report that the Russian Army is upgrading older T-72s to the B3 specification, but losses to artillery and hunter-killer infantry teams with anti-tank weapons are believed to be substantial.

**“SEVERAL UPGRADES HAVE INCLUDED
EXPLOSIVE REACTIVE ARMOUR (ERA),
NUCLEAR, BIOLOGICAL AND CHEMICAL
WARFARE (NBC) EQUIPMENT AND VARIOUS
INFRARED FIRE-CONTROL SYSTEMS”**





Above: A pro-Russian separatist stands in front of a T-72 tank at a checkpoint in Enakieve, 25 kilometres (15 miles) from the eastern Ukrainian city of Debaltseve, 29 January 2015

CREW COMPARTMENT

Characteristically, the crew compartment of the T-72 main battle tank was not built for comfort. The chassis of the tank was divided into three sections, with the crew compartment in the centre. The driver was situated forward, with limited visibility through only a single periscope and, unlike Western tank designs that utilised a wheel or yoke, a system of tillers was used to steer. Along with the manual transmission, the driver was fully occupied while the tank was in motion. An automatic loader eliminated the need for a fourth crewman, and the commander was positioned in the turret to the right beneath a rotating cupola, while the gunner was seated in the turret to the left. The maximum height for T-72 crewmen is believed to be 1.75 metres (five foot nine inches).



Below: Upgraded variants such as the T-72B3 are reported by Western intelligence to be in service with the Russian Army in Ukraine



The driver has only limited visibility through a single periscope

Images: Alamy, Getty, Wikid / PD / Gov

THE FUTURE OF TANKS

Despite an ever-evolving battlefield, tanks will continue to have a key role to play in the wars of tomorrow

WORDS MICHAEL E. HASKEW

Some military analysts, scholars and theorists have determined that the time has come to write the epitaph for the tank as a weapon of war. Long gone, they say, are the days when these behemoths can rule with firepower, armour protection and mobility.

Others counter with the sentiment that such has been said of virtually every major weapons system in modern military history: the battleship, the aircraft carrier, the fighter aircraft, the helicopter, the armoured car, and even the individual soldier. They argue that while military technology continues to advance, existing weapons systems respond via their

own upgrades and thereby improve in terms of battle deliverables and survivability.

In the case of the tank, which in recent years has entered its second century of warfare, its opponents have desperately sought effective ways to kill it since it first appeared on the battlefield. Consider these early options – opposing tanks, artillery fire, mines, tank-killer infantry squads, trained dogs, and even suicide squads. The anti-tank gun, bigger and more lethal mines, upgraded armour-piercing ammunition, anti-tank guided missiles, and other means of defeating the tank have all emerged since WWII.

The truth regarding what the future holds for the tank lies somewhere in between the two polar opposites. During the modern era, the military establishments of the world's industrialised nations have invested billions in order to advance, upgrade and improve the lethality of the main battle tank. The introduction of explosive reactive armour, radar-jamming apparatus, nuclear-biological-chemical defences (NBC), chaff and other decoy systems, state-of-the-art target acquisition and better weaponry have all contributed to the ever-improving capabilities of the tank.

The U.S. military is certainly putting its faith in the futuristic AbramsX





A Russian T-90 drives through Red Square in Moscow

In opposition to the tank's evolving prowess, the development of the anti-tank weapon has proceeded at a staggering pace. From the shoulder-fired bazooka, PIAT, and Panzerfaust of WWII, there have emerged the Soviet-made RPG, the U.S. human-portable M72 LAW and BGM-71 TOW missiles, in addition to Sweden's NLAW (Next Generation Light Anti-tank Weapon), the American FGM-148 Javelin, and other anti-tank systems. These are but a few of the latest generational weapons employed with ground troops. In the air, the American Apache and Russian Kamov Ka-52 Alligator were designed, built and deployed for the purpose of destroying opposing armour.

Nations continue to pour money into research and development in both the tank and the anti-tank spheres of warfare. The British Challenger 2 tank has undergone multiple upgrades. The U.S. M1A3 Abrams is

expected to be the last version of its line, but in the meantime the commitment of the SEP (Systems Enhancement Package) and other upgrades are expected to maintain the M1A2 as the frontline tank of the U.S. Army. At the same time, Germany continues to improve its Leopard series with the 2A7, the latest in a line of formidable machines that traces its earliest deployment back to the 1960s.

Despite the media coverage of the current war in Ukraine and the reports of heavy Russian tank losses, it must be stated that a tank is only as good as the strategic planning, tactical acumen and operational competence of the individuals deploying it.

Reports indicate that dozens of the most recent Russian T-90 main battle tank have been lost. However, estimates of those that were abandoned – rather than destroyed – run as high as 34 per cent. Further indications that

the Russian T-14 Armata has been tested and withdrawn have also surfaced. In the case of both tanks, analysts debate the precise cause of the total amount of losses, as well as those of older Soviet-era models, such as the T-72 and even reaching back to the decades-old T-62 and T-54.

Meanwhile, Ukraine has clamoured for the German-built Leopard 1 in upgraded variants of a system that entered service with the Bundeswehr in 1965 and later became a popular purchase on the export market. Numerous nations have responded, sending dozens of these tanks to the beleaguered country, while other Western types have also been forwarded to the Ukrainian armed forces.

One observer said of the situation in Ukraine, "The Russian tanks didn't fare well. They were taken out pretty quickly by modern anti-tank systems, and I think that would be a problem also for U.S. tanks in a future conflict." Another said, "When you look at how combat has proceeded, and Ukraine has been a great example of that, tanks have been very important to be able to gain and take territory. You need something that's going to have some protection behind it, that's going to allow infantry to be able to either use it for cover or use it for indirect fires."

The implication for the future is clear. The tank is expected to remain a viable battlefield weapons system at least for the next half century, evolving and adapting while anti-tank weaponry does the same, in a deadly game of military cat and mouse.

"THE DEVELOPMENT OF THE ANTI-TANK WEAPON HAS PROCEEDED AT A STAGGERING PACE"



German Leopard 1A5 tanks were provided to Ukraine to fight the Russian invasion in 2023

HISTORY'S GREATEST TANKS

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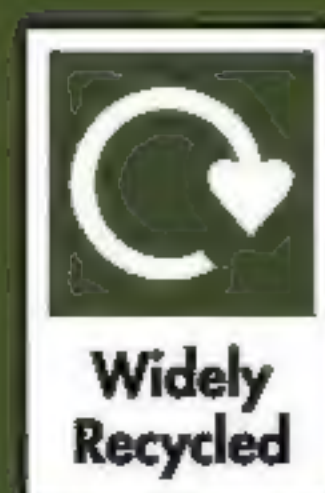
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